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ABSTRACT

The program planning guide for agricultural mechanics was written to assist Applied Biological and Agricultural Occupations (ABAO) teachers in enriching existing programs and/or to provide the basis for expansion of offerings to include additional materials for the cluster areas of agricultural power and machinery, structural and conveniences, mechanics skills, construction and maintenance, electrification, and soil/water management. Each guide includes the following components: an introduction (brief discussion of the subject matter); sample job titles and cluster areas (major job titles, D.O.T. numbers, O.E. numbers, and information about salaries, educational requirements, and career advancement opportunities); competencies for cluster areas and for job titles, stated as behavioral objectives; a core course outline (a representative sample of how a curriculum should be constructed, including references); sample teaching plans designed for one to five days in length (comprising cluster areas, unit titles, problem areas, a brief introduction, student performance objectives, a detailed outline of instructional content, learning activities, special materials and equipment, and student references). Also included are: specific and selected references; a brief description of school facilities; lists of equipment, supplies, and audiovisual materials; and a partial list of ways to increase teacher competencies. (BP)

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Volume III

PROGRAM PLANNING GUIDE IN AGRICULTURAL MECHANICS

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Development of Teachers' Guide and Students' Instructional Materials for Seven Selected Applied Biological and Agricultural Occupation Related Areas (PCB-A5-031)

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INTRODUCTION

The Program Planning Guides were written to assist the Applied Biological and Agricultural Occupations teacher in enriching the existing programs and/or to provide the basis for expansion of offerings to include an additional agricultural cluster area. For example, the current offering may be Agricultural Production with Agricultural Mechanics, and Agricultural Supplies and Services is to be added to the offering.

These guides are the result of a funded project coordinated by the Professional and Curriculum Development Unit, Division of Vocational and Technical Education, Board of Vocational Education and Rehabilitation in cooperation with the Agricultural Industries Department, Southern Illinois University, Carbondale, during the FY 1975. The project was entitled "Development of Teachers' Guide and Student Instructional Materials for Seven Selected ABAO (Applied Biological and Agricultural Occupations) Related Areas." The seven ABAO areas selected include:

1. Agricultural Production - O.E. Code 01.0100
2. Agricultural Supplies and Services - O.E. Code 01.0200
3. Agricultural Mechanics - O.E. Code 01.0300

4. Agricultural Products - O.E. Code 01.0400
5. Ornamental Horticulture - O.E. Code 01.0500
6. Agricultural Resources - O.E. Code 01.0600
7. Forestry - O.E. Code 01.0700

Major division, cluster area, and job titles were written with O.E. numbers, and only an occasional reference to D.O.T. The O.E. code was selected in that teachers in Illinois classify all of their students under this system.

The provisions of the SIU/C-DVTE project provided an opportunity for participation from throughout the Illinois Applied Biological and Agricultural Occupations staff. Each member contributed in his unique way, and they represent each of the four institutions which train DVTE staff, V.A.S., and ABAO teachers in community colleges and high schools.

The projects activities were coordinated by a Steering Committee. All major decisions on content, format, job titles, and final draft approval were the responsibility of the steering committee. They spent considerable time and effort in reviewing these guides. The steering committee was composed of the following members:

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Each guide includes the following component parts.

Introduction Unique consideration for the subject matter area.

Sample Job Titles and Cluster Areas This includes information about salary, education requirements and career advancement opportunities. These job titles and cluster areas are coordinated with a brochure entitled "Applied Biological and Agricultural Occupations Career Directory" published by the Division of Vocational and Technical Education, 1035 Outer Park Drive, Springfield, IL.

Competencies for Cluster Areas and Competencies for Job Titles The competencies, stated in measurable terms, are presented by cluster areas and job titles.

Core Course Outline The core course outline is a representative sample of how a curriculum could be constructed to present the program.

Exemplary Teaching Plans This is a section which incorporates teaching plans for selected units in the outline. Their function is to provide sample plans which the ABAO teacher may follow in developing his respective units.

Reference The references are coded into the teaching plan and listed with their source in the reference section.

School Facilities, Equipment, and Supplies This provides the ABAO teacher with a source for major items which will be required to operate the program.

Audio Visual Materials This is a listing of currently available visual materials for use in teaching the respective subject matter areas.

Teachers Competencies and Training Available This is a brief review of sources where the teacher could secure additional skills to assist in delivering a quality program.

These Program Planning Guides were prepared to improve the quality and increase the scope of Applied Biological and Agricultural Occupations offerings available in Illinois. The Guides can only be successful with your review, adaption, adoption, and implementation.

INTRODUCTION TO AGRICULTURAL MECHANICS PROGRAM PLANNING GUIDE

For the purposes of this program planning guide, agricultural mechanics will be understood to mean a combination of subject matter and activities designed to develop abilities necessary for assisting with and/or performing the common and important operations or processes concerned with the selection, operation, maintenance, and use of agricultural power, agricultural machinery and equipment, structures and utilities, soil and water management, and agricultural mechanics shop, including kindred sales and services. There is hardly a phase of agriculture in which mechanics does not play a significant role.

The information provided should be helpful for all professional personnel in Illinois who have either direct or indirect responsibilities for preparing high school students for employment in the agricultural mechanics field. Examples of such personnel are: instructors of applied biological and agricultural occupations (ABAO), guidance counselors, high school administrators, vocational and technical education staff members, and university teacher education faculty.

There are many skills and understandings which are common to more than one area of agricultural mechanics. Yet each area has its own unique applications and requirements. Mindless applications of skills is something which must be avoided by those who wish to succeed in agricultural mechanics. The reasons for doing things in particular ways are important to know, and proper technique and correct sequence of operations can prevent serious accidents, or even fatal results.

Agricultural mechanics job titles, numbers, and descriptions will seldom have corresponding listings in the U.S. Department of Labor publications: Dictionary of Occupational Titles and Occupational Outlook Handbook. There will be many listings which will have relevance for the student preparing for an agricultural mechanics occupation, however. Students may be either male or female.

In general, the educational and experience background needed for an entry level job in agricultural mechanics will mean the acquiring of a broader range of skills and understandings than would be necessary for a corresponding job in other industries. While there can be highly specialized jobs in agricultural mechanics, the greater need is much more likely to be for an individual who can do quite a wide range of tasks rather well.

Shops devoted entirely to small engine repair are quite common in large urban centers. A large automobile

and truck dealership in a city may employ a mechanic who seldom works on anything but trucks (truck mechanic) and another whose time is mainly used for the front ends of automobiles (front end mechanic). The implement and tractor dealership in a rural area, on the other hand, may employ only a few mechanics, and each may be expected to make comprehensive repairs on both spark ignition engines and diesel engines, as well as on other parts of the tractor. They also may work on the various components of combines and other implements.

Given appropriate instruction in the proper use of reference materials and other resources, the student should be able to:

1. Seek information about job opportunities in agricultural mechanics in Illinois
2. Determine the competencies and requirements needed by persons to enter and advance in each specific job
3. Discover the job for which he has the greatest aptitude and interest
4. Develop a personal plan which will aid him in acquiring the competencies and meeting the requirements needed for entry into that job
5. Follow the procedure necessary to obtain a job
6. Do the things which will enable him to succeed in the job

7. Identify higher level jobs which he might aspire to

Curriculum guides and/or instructional materials from Arizona, Georgia, Illinois, Indiana, Iowa, Minnesota, Missouri, Nebraska, New Hampshire, New York, Ohio, Pennsylvania, South Carolina, Texas and Virginia were reviewed and provided useful insights for the development of this guide.

SAMPLE CLUSTER AREAS AND JOB TITLES

The cluster areas and job titles included in this guide are:

- Agricultural Power and Machinery
  - Serviceman
  - Machinery Setup Man
  - Parts Man
- Agricultural Structure and Conveniences
  - Structure Salesman
  - Crew Member
- Soil and Water Management for Agricultural Lands and Public Recreational Areas
  - Conservation Technician
- Agricultural Mechanics Skills
  - Machinery Repairman
- Agricultural Construction and Maintenance
  - Agriculture Structure Erector
- Agricultural Electrification
  - Safety Technician

JOB DESCRIPTION

MAJOR JOB TITLE:	Serviceman
O.E. NUMBER:	01.030101
LOCATION:	Employed by agricultural equipment dealers in many areas of Illinois.
SALARY:	Beginning salary for high school graduate with no experience is usually an hourly wage of $3.00 to $4.00.
EDUCATION:	High school diploma required. Two-year degree from a community college desirable.
CAREER ADVANCEMENT:	Serviceman Trainee Serviceman Service Manager Owner

MAJOR JOB TITLE:	Machinery Setup Man
O.E. NUMBER:	01.030105
LOCATION:	Employed by agricultural equipment dealers in many areas of Illinois.
SALARY:	Beginning salary for high school graduate with no experience is an hourly wage of $2.50 to $3.50.
EDUCATION:	High school diploma desirable. Additional education enhances advancement opportunities.
CAREER ADVANCEMENT:	Machinery Setup Man Helper Machinery Setup Man Assistant Manager Manager Part Owner Owner

MAJOR JOB TITLE:	Parts Man
O.E. NUMBER:	01.030106
LOCATION:	Employed by agricultural equipment dealers in many areas of Illinois.
SALARY:	Beginning salary for high school graduate with no experience is a wage of $3.00 to $4.00 per hour and a certain percentage of sales. The two-year community college or four-year university graduate whose training has emphasized agricultural power and machinery may expect a salary of between $7,500 to $8,500 per year plus commissions on sales made.
EDUCATION:	High school diploma required. Two-year degree from a community college is desirable. B.S. Degree is helpful for advancement.
CAREER ADVANCEMENT:	Parts Man Trainee Parts Man Manager Owner

MAJOR JOB TITLE:	Structure Salesman
O.E. NUMBER:	01.030205
LOCATION:	Employed by agricultural structures and conveniences dealers in many areas of Illinois.
SALARY:	Beginning salary for high school graduate with no experience is $5,600 to $7,600 per year plus sales commissions.
EDUCATION:	High school diploma required. Two-year degree from a community college is desirable. B.S. Degree with an emphasis on agricultural structures and conveniences is helpful for career advancement.

CAREER ADVANCEMENT:	Structure Salesman Trainee Structure Salesman Sales Manager Dealer
MAJOR JOB TITLE:	Crew Member
O.E. NUMBER:	01.030208
LOCATION:	Employed by agricultural structures and conveniences dealers in many areas of Illinois.
SALARY:	Beginning salary for high school graduate with no experience is a wage of $2.50 to $3.25 per hour.
EDUCATION:	High school diploma desirable. Additional education is helpful for career advancement.
CAREER ADVANCEMENT:	Crew Member Setup Manager General Manager Part-Owner of Dealership Full-Owner of Dealership
MAJOR JOB TITLE:	Conservation Technician
O.E. NUMBER:	01.030403
LOCATION:	Employed by Soil and Water Conservation Districts in Illinois.
SALARY:	Beginning salary for high school graduate with no experience is a wage of $2.50 to $3.50 per hour.
EDUCATION:	High school diploma required. Additional education is required for significant career advancement. Higher level positions are occupied by individuals holding the B.S. Degree.

CAREER ADVANCEMENT:	Conservation Technician Trainee Conservation Technician Manager Conservationist
MAJOR JOB TITLE:	Machinery Repariman
O.E. NUMBER:	01.030501
LOCATION:	Employed by agricultural equipment dealers, independent repair shops, and service departments of agricultural equipment wholesalers and manufacturers in Illinois.
SALARY:	Beginning salary for high school graduate with no experience is a wage of $3.00 to $4.00 per hour.
EDUCATION:	High school diploma generally required. Two-year degree from a community college desirable.
CAREER ADVANCEMENT:	Machinery Repairman Helper Machinery Repairman General Shop Foreman Manager Owner
MAJOR JOB TITLE:	Agriculture Structure Erector
O.E. NUMBER:	01.030601
LOCATION:	Employed by agricultural construction and maintenance businesses in Illinois.
SALARY:	Beginning salary for high school graduate with no experience is a wage of $2.50 to $3.50 per hour.
EDUCATION:	High school diploma generally required. Additional education is helpful for career advancement.
CAREER ADVANCEMENT:	Agriculture Structure Erector Trainee Agriculture Structure Erector On-Site Supervisor General Manager Owner

MAJOR JOB TITLE:	Safety Technician -- Agricultural Electrification
C.E. NUMBER:	01.030704
LOCATION:	Employed by service companies, both public and private, in Illinois. Other employers are state and federal safety agencies and a wide variety of agricultural businesses. In some cases, the job is combined with other duties.
SALARY:	Beginning salary for high school graduate with no experience is $5,500 to $7,500 per year.
EDUCATION:	High school diploma required. Additional education necessary for significant career advancement. B.S. Degree required for higher level positions.
CAREER ADVANCEMENT:	Safety Technician Trainee Safety Technician Service Company Representative Service Company Manager

COMPETENCIES FOR CLUSTER AREAS

III. Agricultural Mechanics

A. Agricultural Power and Machinery

1. Selection

The student will be able to:

EE a. From a group of different makes, models, and types of tractors commonly used in Illinois, pick out the one which is best for a particular agricultural situation according to Nebraska Tractor Test standards, American Society of Agricultural Engineers standards, size of operation involved, costs, types of uses to which the tractor will be put, dealer competence and reputation for service, owner abilities and preferences, and related factors.

EE b. From a group of different makes and models of small engines commonly used in Illinois, pick out the one which is best for a particular agricultural situation according to information provided by owners manuals, service manuals, Implement and Tractor Small Engines Manual, and reports from independent testing agencies.

EE c. From a group of different makes and models of each category of agricultural implement or machine commonly used in Illinois, pick out the one which is best for a particular agricultural situation according to American Society of Agricultural Engineers standards, size of operation involved, costs, types of uses to which the unit will be put, dealer competence and reputation for service, owner abilities and preferences, and related factors.

KEY: EE-ESSENTIAL for ENTRY
DA-DESIRABLE for ADVANCEMENT

DA d. From owner manuals, list the special features of different makes, models, and types of tractors commonly used in Illinois. Determine the comparative value of the special features listed, and determine deficiencies by comparing with American Society of Agricultural Engineers standards, National Safety Council recommendations, and specialized published information about the various components comprising the special features.

DA e. Do the same as d (above) for a group of different makes and models of each category of agricultural implement or machine commonly used in Illinois.

2. Operation

The student will be able to:

EE a. Given any make, model, and type of tractor commonly used in Illinois, operate it safely and efficiently according to the standards established by the owner's manual, the laws of Illinois, and the U. S. Department of Labor regulations on hazardous occupations in agriculture.

EE b. Do the same as a (above) for any agricultural implement or machine (including small engines) commonly used in Illinois.

DA c. Given owners manuals for different makes, models and types of tractors commonly used in Illinois, determine which provides the best information on an overall basis, which provides the most complete list of safety precautions, which has the best illustrations, and which is the easiest to use.

DA d. Given owners manuals for a group of different makes and models of each category of agricultural implement or machine (including small engines) determine the same things as for c (above).

3. How They Work and Maintenance

The student will be able to:

EE a. Given the owner's manual, service manuals, and proper tools and materials for any make, model, and type of tractor commonly used in Illinois, explain how it works and perform the required maintenance jobs according to the information, directions and specifications found in the manuals and other appropriate references.

EE b. Do the same as a (above) for any agricultural implement or machine (including small engines) commonly used in Illinois.

DA c. Given owners manuals and other appropriate references for different makes, models, and types of tractors commonly used in Illinois, determine which provides the most complete and most easily understood "how they work" and maintenance information.

DA d. Do the same as c (above) for agricultural implements or machines (including small engines) commonly used in Illinois.

4. Testing and Analysis

The student will be able to:

EE a. Given any make, model, and type of tractor commonly used in Illinois and the correct test equipment and testing tools, determine the condition of the various tractor systems and components according to the standards established by the test equipment and testing tools manufacturers, owner's manual general service manual, and special shop service manual.

(1) Analyze the results and accurately determine the correct actions to take as indicated by the tests, according to the standards established by the publications listed in a (above).

EE b. Do the same as a and a (1) (above) for any agricultural implement or machine (including small engines) commonly used in Illinois.

DA c. Given the manuals listed in a (above) for different makes, models, and types of tractors commonly used in Illinois, determine (in the case of each group) which provides the most complete and most easily understood testing and analysis information.

DA d. Do the same as c (above) for manuals of agricultural implements or machines (including small engines) commonly used in Illinois.

5. Tune-up and Repair

The student will be able to:

EE a. Given any make, model, and type of tractor commonly used in Illinois, the correct analysis of test results for that tractor, and the correct tune-up, servicing, and repair tools, perform the needed jobs to the specifications listed in the owner's manual, general service manual, and special shop service manual.

EE b. Do the same as a (above) for any agricultural implement or machine (including small engines) commonly used in Illinois.

DA c. Given the manuals listed in a (above) for different makes, models, and types of tractors commonly used in Illinois, determine (in the case of each group) which provides the most complete and most easily understood tune-up and repair information.

DA d. Do the same as c (above) for manuals of agricultural implements or machines (including small engines) commonly used in Illinois.

6. Tool Identification, Use and Safety

Student will be able to:

EE a. Given any tool in the agricultural power and machinery area of agricultural mechanics, identify it and use it correctly and safely according to standards established by the tool manufacturer, the National Safety Council, and standard agricultural mechanics publications on this subject.

EE b. Given any tool in the agricultural power and machinery area of agricultural mechanics, identify it by all the names it might be called and name all the principal parts as well. The standards established by the tool manufacturer and standard agricultural mechanics and industrial mechanics publications will be utilized in determining the accuracy of performance for this competency.

7. Customer Relations

Student will be able to:

EE a. While employed in an agricultural power and machinery dealership, describe the organization of personnel in the various departments and the role of each person at a level of performance acceptable to the instructor.

EE b. While working in the equipment sales department, assist the salesman in completing the various equipment sales records used by the dealership at a level of performance satisfactory to the sales manager.

EE c. While working in the service department, follow the instructions as outlined on a shop service ticket prepared by the service manager, complete the time portion of the ticket, and request additional parts from the parts department using the appropriate procedures to the satisfaction of the employer.

EE d. While working in the parts department, bin and store parts, maintain inventory records, and complete customers' parts orders with complete accuracy as determined by the parts manager or employer.

EE e. While employed in an agricultural power and machinery dealership, pass a written examination with 90 percent accuracy which has been developed by the instructor and personnel of the dealership.

Note: There might be such a written examination about each department, and a comprehensive examination about the entire business.

B. Agricultural Structures and Conveniences

1. Farmstead Planning

The student will be able to:

EE a. Given a specific existing family and farm situation, develop family and farm goals which can be achieved to a considerable extent by appropriate farmstead planning. The accuracy of the goals will be checked against the standards established by the Farmstead Planning Handbook, Midwest Plan Service, Cooperative Extension Service publications; United States Department of Agriculture publications.

EE b. Given a set of family and farm goals, draw a farmstead plan to meet the guidelines and specifications listed in the publications referred to in a (above).

EE c. Given a list of common and technical terms related to farmstead planning, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers developed from farmstead planning and related publications.

2. Structures

The student will be able to:

EE a. Given a complete description of a building and its surroundings in an agricultural situation, correctly appraise its value for its current use according to standards established by "Appraising Farm Buildings," Vocational Agriculture Service; and Farmstead Planning Handbook, Midwest Plan Service.

EE b. Given a complete description of a building and its surroundings in an agricultural situation, correctly determine two remodeling plans which will increase its usefulness according to standards established by the publications referred to in a (above).

EE c. Given a number of questions about materials, loads, designs, and agricultural building construction, answer with 90 percent accuracy as measured by the list of approved answers developed from Structures and Environment Handbook, Midwest Plan Service; Engineering Applications in Agriculture by Bowers, Jones, and Olver; Cooperative Extension Service publications; Vocational Agriculture Service subject-matter units; and information from manufacturers and trade associations.

EE d. Given the proper equipment, tools, and materials, perform the common mechanical jobs associated with agricultural structures efficiently and safely to standards indicated by generally accepted agricultural mechanics and industrial publications.

EE e. Given a list of common and technical terms related to agricultural structures, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers obtained from agricultural mechanics and industrial publications.

3. Conveniences

The student will be able to:

EE a. From a group of different plumbing tools and supplies, pick out the one in each category which is best for a particular agricultural plumbing situation according to standards established by generally accepted agricultural mechanics and industrial publications.

EE b. Given the proper plumbing tools and supplies, perform the common plumbing jobs associated with agricultural plumbing efficiently and safely to standards indicated by state and local plumbing codes.

EE c. Given a list of common and technical terms related to agricultural conveniences, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers obtained from agricultural mechanics and industrial publications.

4. Tool Identification, Use, and Safety

The student will be able to:

EE a. Given any tool in the agricultural structures and conveniences area of agricultural mechanics, identify it and use it correctly and safely according to standards established by the tool manufacturer, the National Safety Council, and standard agricultural mechanics publications on this subject.

DA b. Given any tool in the agricultural structures and conveniences area of agricultural mechanics, identify it by all the names it might be called and name all the principal parts as well. The standards established by the tool manufacturer and standard agricultural mechanics and industrial mechanics publications will be utilized in determining the accuracy of performance for this competency.

C.&D. Soil and Water Management for Agricultural Lands and Public Recreational Areas

1. Selection, operation and how equipment and machinery units work, maintenance, testing and analysis, tune-up and repair, and tool identification, use and safety

   The student will be able to:

   Similar objectives here as for agricultural power and machinery area of agricultural mechanics.

2. Agricultural Surveying and Land Descriptions

   The student will be able to:

   EE a. Given the proper equipment, tools, and materials catalogs, select the best equipment, tools, and materials for the particular set of circumstances encountered in agricultural surveying and land description work to standards established by the Soil Conservation Service and the United States Department of Agriculture.

   EE b. Given the proper equipment, tools, and materials, perform the common agricultural mechanics jobs associated with agricultural surveying and land description work to standards established by the Soil Conservation Service and the United States Department of Agriculture.

   EE c. Given a list of questions about agricultural surveying and land description work, answer with 90 percent accuracy according to standards established by publications generally recognized as authoritative.

   EE d. Given a list of common and technical terms related to agricultural surveying and land description work, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers obtained from publications generally recognized as authoritative.

3. Terracing

The student will be able to:

Similar objectives here as for agricultural surveying and land descriptions (above).

4. Grass Waterways

The student will be able to:

Similar objectives here as for agricultural surveying and land descriptions (above).

5. Land Drainage

The student will be able to:

Similar objectives here as for agricultural surveying and land descriptions (above).

6. Farm Ponds

The student will be able to:

Similar objectives here as for agricultural surveying and land descriptions (above).

7. Estimating Costs

The student will be able to:

EE a. Given the specifications for any soil and water management for agricultural lands and public recreational areas job, estimate the total cost with 90 percent accuracy as measured by the most accurate and recent information available from the local Soil and Water Conservation District or other authoritative source.

E. Agricultural Mechanics Skills

1. Planning, Equipping and Maintaining an Agricultural Shop

The student will be able to:

EE a. Given a particular situation requiring either a completely new agricultural shop or extensive replanning, etc., of a present inadequate one, and appropriate references, draw up a comprehensive plan for establishing, equipping and maintaining a good shop as measured by information in the Farmstead Planning Handbook, Midwest Plan Service, and other references listed in the references section of this program planning guide.

EE b. Given a list of questions about planning, equipping and maintaining an agricultural shop, answer with 90 percent accuracy according to standards and information provided by publications generally recognized as authoritative. Authoritative references are listed under each section of the core course outline.

EE c. Given a list of common and technical terms related to planning, equipping, and maintaining an agricultural shop, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers developed from authoritative publications.

2. Making and Reading Sketches, Plans and Drawings

The student will be able to:

EE a. Given the proper tools and equipment, prepare a sketch, plan, or drawing of a particular object as specified, to standards established by Engineering Drawing by Zozzora.

EE b. Given an engineering drawing, be able to read and interpret it according to standards established by the publications listed in this section of the core course outline.

EE c. Given a list of questions about making and reading sketches, plans and drawings, answer with 90 percent accuracy according to standards and information provided by the publications listed in this section of the core course outline.

EE d. Given a list of common and technical terms and symbols related to making and reading sketches, plans and drawings, explain their meanings and significance with 90 percent accuracy as measured by the publications listed in this section of the core course outline.

3. Arc Welding

The student will be able to:

EE a. Given a particular situation and appropriate catalogs, select the best equipment and supplies for arc welding to standards established by the local power supplier and publications listed in this section of the core course outline.

EE b. Given a specified shop exercise, repair job, or project and the correct equipment and supplies, perform the arc welding operations necessary to meet the specifications. Setting up and maintaining equipment exercises are included as well as the actual welding of metal, cutting of metal, etc. Do this in an efficient and safe manner according to the standards established by the publications listed in this section of the core course outline.

EE c. Given a list of questions about arc welding, answer with 90 percent accuracy as measured by the list of approved answers obtained from the publications listed in this section of the core course outline.

EE d. Given a list of common and technical terms and symbols related to arc welding, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers obtained from the publications listed in this section of the core course outline.

EE e. Given any tool in the arc welding area of agricultural mechanics, identify it and name its principal parts correctly, and use it efficiently and safely according to standards established by the tool manufacturer and the publications listed in this section of the core course outline.

4. Oxyacetylene Welding

The student will be able to:

Similar objectives here as for arc welding (above).

5. Metal Inert Gas (MIG) Welding

The student will be able to:

Similar objectives here as for arc welding (above), except there is only one publication listed in the MIG section of the core course outline.

6. Tungsten Inert Gas (TIG) Welding

The student will be able to:

Similar objectives here as for arc welding (above), except there is only one publication listed in the TIG section of the core course outline.

Objectives related to the solving of possible problems with the equipment are more important with the more complicated MIG and TIG welding equipment than is the case for either arc or oxyacetylene welding equipment.

7. Soldering in Agriculture

The student will be able to:

EE a. Given a particular situation and appropriate catalogs, select the best equipment and supplies for soldering to standards established by manufacturers and Soldering for Home, Farm, and Shop by Vocational Agriculture Service.

EE b. Given a specified shop exercise, repair job, or soldering project and the correct equipment and supplies, perform the soldering skill necessary to meet the specifications. Do this in an efficient and safe manner according to standards established by manufacturers and the publication listed in a (above).

Similar objectives for c, d, and e as for arc welding.

8. Agricultural Metal Work

The student will be able to:

EE a. Given a particular situation and appropriate catalogs, select the best equipment and supplies for cold and hot metal work to standards established by manufacturers and the publications listed in the cold metal and hot metal sections of the core course outline.

Similar objectives for b, c, d, and e as for arc welding.

9. Tool sharpening and Fitting

The student will be able to:

EE a. Given a particular situation and appropriate catalogs, select the best equipment and supplies for tool sharpening and fitting to standards establsihed by manufacturers and the publications listed in this section of the core course outline.

Similar objectives for b, c, d, and e as for arc welding.

10. Woodworking -- Hand and Power Tools

The student will be able to:

EE a. Given a particular situation and appropriate catalogs, select the best equipment and supplies for woodworking with hand and power tools to standards established by manufacturers and the publications listed in this section of the core course outline.

Similar objectives for b, c, d, and e as for arc welding.

Note: Although only "a particular situation" is mentioned under various headings, the intent is to have several (sometimes many) practical situations, depending upon the circumstances. The same is true for "a specified shop exercise, repair job, or project."

Even though some published standard of performance generally is available for judging how well a student has met an objective, the agricultural mechanics instructor is the one who must make the comparison or at least help the student make the comparison. In cases where a published standard is not available, the instructor's judgment (or the combined judgment of the student and the instructor) is likely to be the most reliable evaluation.

It should be remembered that the subjective judgment of another authority can be valuable in determining how well objectives have been accomplished. A professional welder, for example, could be of considerable help in judging a welding project's quality.

F. Agricultural Construction and Maintenance

1. Water Supply System

The student will be able to:

EE a. Given a specific existing family and farm situation, draw a plan for a water supply system complete with a list of specifications for purchasing needed components according to the laws and regulations of the area and Private Water Systems, Midwest Plan Service.

EE b. Given a plan for a water supply system, perform the common agricultural mechanics jobs necessary for installing the system according to the state codes, local codes, laws and regulations of the area, and information furnished by the publication referred to in a (above). Use proper procedures and safety practices.

EE c. Given a description of a water supply system, develop a plan for correctly maintaining it according to the standards established by the publications listed in this section of the core course outline.

EE d. Given a number of questions about the various parts of a water supply system and facts relating to the selection, installation, and maintenance of the system, answer with 90 percent accuracy as measured by the list of approved answers developed from the publications listed in this section of the core course outline.

EE e. Given a list of common and technical terms related to water supply systems, explain their meanings and significance with 90 percent accuracy as measured by the list of approved answers developed from the publications listed in this section of the core course outline.

2. Waste Disposal System

The student will be able to:

Similar objectives here as for water supply (above).

3. Grain-Feed Handling for Livestock and Cash-Grain Farms

   The student will be able to:

   Similar objectives here as for water supply (above).

4. Estimating Costs

   The student will be able to:

   EE a. Given the specifications for any agricultural construction and maintenance job, estimate the cost with 90 percent accuracy as measured by comparison with similar jobs completed in the area most recently.

G. Agricultural Electrification

1. Electrical Hazards on the Farm

The student will be able to:

EE a. Given proper inspection forms, inspect any farm (or other agricultural location) for safety hazards and make appropriate recommendations for the correction of any hazards found according to the standards established by the publications listed in this section of the core course outline.

EE b. Given a number of questions about electrical hazards on the farm and at other agricultural locations, answer with 90 percent accuracy as measured by the list of approved answers obtained from the publications listed in this section of the core course outline.

EE c. Given a list of common and technical terms and symbols related to electrical hazards on the farm, explain their meanings and significance with 90 percent accuracy as measured by a list of approved answers obtained from the publications listed in this section of the core course outline.

2. Planning for Electrical Wiring

The student will be able to:

EE a. Given a specific existing family and farm situation, draw an electric wiring plan complete with a list of all devices and materials needed according to National Electrical Code and local electrical code standards.

Similar objectives for b and c as for electrical hazards on the farm (above).

3. Electrical Wiring Procedures

The student will be able to:

EE a. Given the proper equipment, tools, and supplies, perform the common mechanical jobs associated with electrical wiring efficiently and safely to standards established by the National Electrical Code,

local electrical code, and the publications listed in this section of the core course outline.

Similar objectives for a and b as for electrical hazards on the farm.

4. Applying Electrical Controls in Farm Production

The student will be able to:

EE a. Given the proper equipment, tools, and supplies, perform the mechanical jobs associated with the application of electrical controls in farm production efficiently and safely to standards established by the National Electrical Code, local electrical code, and the publications listed in this section of the core course outline.

Similar objectives for a and b as for electrical hazards on the farm.

5. Residential and Farm Electric Motors

The student will be able to:

EE a. Given the proper equipment, tools, and supplies, perform the mechanical jobs associated with the residential and farm use of electric motors efficiently and safely to standards established by the National Electrical Code, local electrical code, and the publications listed in this section of the core course outline.

Similar objectives for a and b as for electrical hazards on the farm.

COMPETENCIES FOR JOB TITLES

III. Agricultural Mechanics

A. Agricultural Power and Machinery Serviceman

1. Selection

The student will be able to:

EE a. Given a make, model, and type of tractor commonly used in the community, operate it correctly and safely following procedures provided by the owner's manual, as measured by his ability to pass a written examination and practical test with 90 percent accuracy.

The written examination and practical test are described in Safe Tractor and Farm Machinery Operation available from the Illinois Curriculum Management Center, State of Illinois, Division of Vocational and Technical Education, Springfield.

EE b. Given a make, model, and type of tractor commonly used in the community, needed equipment, tools, materials, and inspection forms, clean and inspect it to determine servicing jobs which need to be performed. Do this with 90 percent accuracy to standards established by the owner's manual, general service manual, and special shop service manual.

EE c. Given a service job which needs to be performed on a make, model, and type of tractor commonly used in the community, perform the job to the specifications found in the owner's manual, general service manual, and special shop service manual to 100 percent accuracy.

Examples of service jobs are: replacement and adjustments of carburetor, fuel pump, water pump, and distributor; replacement

KEY:

EE-ESSENTIAL FOR ENTRY

DA-DESIRABLE FOR ADVANCEMENT

and adjustment of distributor breaker points and generator brushes; cleaning spark plug electrodes with sandblasting machine and setting spark plug gap using a feeler gauge packing front wheel bearings; charging battery; complete lubrication.

EE d. Shown a cut-away view of engine with parts numbered, identify the following parts with 90 percent accuracy: valve housing, valve push rods, crankcase breather, exhaust valve, intake valve, piston rings, piston, piston pin, cylinder, connecting rod, connecting rod bearing, flywheel, clutch, camshaft and cams, oil pump, crankshaft, fan belt, water pump, fan, and thermostat.

EE e. Shown a tractor system with parts numbered, identify the parts with 90 percent accuracy according to the manual for that tractor.

An example is the ignition system with the following parts:

spark plugs
spark plug terminals on spark plug cables
spark plug cables
primary cable
secondary cable
secondary cable coil nipple
secondary cable terminal to the coil
ignition coil
coil clamp
drive housing
housing plan
drive housing clip
stud
housing gasket
shaft busing (rear)
oil tube tee
oil tube
distributor
distributor gasket
distributor clasp
distributor nipples on spark plug cables

EE f. Shown a tractor component with parts numbered, identify the parts with 90 percent accuracy.

An example is the fuel filter with the following parts:

filter valve
filter head
bowl gasket
filter element or screen
bowl
bowl bail
jam nut

The owner's manual or service manual for the particular tractor will furnish the information against which the accuracy of the student will be determined.

EE g. Given a diagram of a tractor system or part of a system, explain the overall function and the function of each component in the system according to information in the relevant references listed in the references section of this program planning guide.

An example is the basic starting circuit which starts the engine. The circuit consists of a battery, a starter switch, a motor switch, and a starting motor. The battery supplies energy for the circuit. The starter switch activates the circuit. The motor switch engages the motor drive with the engine flywheel. The starting motor drives the flywheel to start the engine.

EE h. Given any tool in the agricultural power area of agricultural mechanics, identify it and use it correctly and safely according to standards established by the relevant references listed in the references section of this program planning guide.

DA i. Given any tool in the agricultural power area of agricultural mechanics, identify it by all the names it is known by and name all the principal parts as well.

The standards established by the relevant references listed in the references section of this program planning guide will be used to determine the accuracy of performance for this competency.

Note: Unless otherwise stated, the standard of student performance will be at the 90 percent level.

2. Agricultural Machinery

The student will be able to:

EE a. Given any agricultural machine commonly used in the community, operate it correctly and safely following procedures provided by the owner's manual, as measured by his ability to pass a written examination and practical test with 90 percent accuracy.

The written examination and practical test are described in Safe Tractor and Farm Machinery Operation previously referred to under agricultural power.

Examples of agricultural machinery are: moldboard plow, corn picker, combine, forage harvester, mower, baler, crop dryer, manure spreader, and vertical auger.

EE b. Similar objective as for 2 under agricultural power.

EE c. Similar objective as for 3 under agricultural power.

Examples of agricultural machinery service jobs are: replace a plow share; remove and replace worn ring and pinion gears on a four-row corn planter, and time the gears; replace knife sections on the cutter bar of a mower; replace the guard or ledger plates on the cutter bar of a mower; lubricate the combine completely.

EE d. Shown picture or diagrammatic view of an agricultural machine with parts numbered, identify the parts with 90 percent accuracy according to the owner's manual and service manual for that machine.

The principal units of a combine, for example, are: cutting unit, or header; feeding unit; threshing unit; separating unit; cleaning unit; grain-handling unit; hydraulic controls; propulsion drive in case of self-propelled combine.

Each of the principal units have major parts. The major parts of the cutting unit, or header, for example, are: the reel, the dividers, and the cutter bar and auger.

EE e. Shown an agricultural machine principal unit or major part with principal parts numbered, identify the numbered parts with 90 percent accuracy according to the owner's manual and service manual for that machine.

For example, the cutter-bar assembly is a principal unit for a field mower. This assembly includes the cutter-bar, guards, ledger plates, knives, wear plates, knife clips, hinge pins, knife head, inner shoe, outer shoe, swath board, and stick.

EE f. Given a diagram of an operating cycle or similar operation for a particular machine, explain the function of each principal unit and its major parts.

For example, a principal unit of a combine is the cutting unit, or header. The reel briefly holds the crop against the guards until the knives cut the stems, and then it sweeps the cut material onto the platform. The dividers separate the standing grain and define the swath to be cut. They assist in picking up grain which is not standing and gather and guide the standing and other grain to the cutter bar which has the reciprocating knives to cut the stems of the grain. The auger delivers the grain to the feeder.

Similar objectives here as for the last two listed under agricultural power.

Machinery Setup Man

The student will be able to:

EE a. Given knocked-down agricultural machines, proper tools, and instructions for assembly, inspect for missing parts and assemble according to instructions. Do this to 100 percent accuracy as measured against the instructions provided.

EE b. Given assembled agricultural machines, proper tools, supplies, and instructional manuals, make initial adjustments and provide pre-delivery service to 100 percent accuracy as measured against the instructions provided.

EE c. Given assembled agricultural machines, proper equipment, tools, supplies, and directions, load, deliver, and unload the machines at the proper customer location with no damage to the machines.

EE d. Given any tool regularly used in assembling agricultural machines, identify it and use it correctly and safely according to standards established by the tool manufacturer and relevant references listed in the references section of this program planning guide.

Parts Man

The student will be able to:

EE a. Given any of the common agricultural power and machinery parts commonly stocked by a dealer in the area, identify them and look up the code numbers in appropriate parts manuals. Do this to 100 percent accuracy.

EE b. Given an order for a particular part, go to a coded storage bin and get the desired part with 100 percent accuracy. If the part is not available, order it correctly.

EE c. Given an order of parts from the manufacturer or other source of supply, check them for defects, code them, and store in coded storage bins with 100 percent accuracy.

EE d. Given the procedures to be used and the necessary forms, charge customers and the service department for parts, make out appropriate bills, and collect money to 100 percent accuracy.

EE e. Given the procedures to be used and the necessary forms, keep a running inventory of parts on hand, parts ordered, and parts that should be ordered.

EE f. Given defective parts returned to the parts department by customers or mechanics in the service department, check and determine the cause of defects in order to make refunds and to return defective parts to the factory for exchange.

DA g. Given a valve grinding or similar machine, be able to operate it correctly and safely according to the manufacturer's directions.

DA h. Given the proper equipment, tools, and materials, create attractive merchandise displays which compare favorably with sample professional displays in the area.

Note: It will be necessary for the student who wishes to be a parts man to work in a dealership. His work can then be measured against that of the best full-time parts man employed by the business.

Structure Salesman

The student will be able to:

EE a. While working in the agricultural structures business, handle the objections and complaints of a customer to the satisfaction of the instructor and/or employer.

EE b. While working in the agricultural structures business, fill out the appropriate sales forms used by the business to the satisfaction of the employer.

EE c. While working in the agricultural structures business, create attractive sales and displays to the satisfaction of the instructor and employer.

EE d. While working in the agricultural structures business, meet prospective customers and conduct sales presentations to the satisfaction of the teacher and employer.

EE e. Pass a written examination with 90 percent accuracy on salesmanship and the agricultural structures business. The questions and answers will be developed cooperatively by the instructor and personnel from the agricultural structures business.

Crew Member--Agricultural Structures

The student will be able to:

EE a. While working for an agricultural structures business, perform all the tasks assigned efficiently, promptly, and safely to standards established by his instructor, immediate supervisor, and employer.

EE b. While working for an agricultural structures business, assemble prefabricated structures from plans and written instructions provided. Do this to the satisfaction of the instructor, immediate supervisor, and customer.

EE c. Pass a written examination with 90 percent accuracy on the construction phase of the agricultural structures business. The questions and answers will be developed cooperatively by the instructor and personnel from the construction phase of the business.

DA d. While working for an agricultural structures business, determine the highest paying and potentially most satisfying job for which it is possible to qualify. Design an overall, written, specific plan with tentative deadlines for qualifying for the job to the satisfaction of the instructor.

Conservation technician

The student will be able to:

EE a. While working for the Soil Conservation Service and given handbooks, manuals, technical specifications and policy memoranda for guidance, assist landowners and operators individually and in groups to develop conservation plans and get them accepted for cost sharing payments. Do this to the satisfaction of the instructor and immediate supervisor.

EE b. While working for the Soil Conservation Service and given handbooks, manuals, technical specifications and policy memoranda for guidance, assist landowners and operators individually and in groups to establish conservation practices in accordance with conservation plans. Do this to the satisfaction of the instructor and immediate supervisor.

EE c. While working for the Soil Conservation Service and given handbooks, manuals, technical specifications and policy memoranda for guidance, assist landowners and operators and review plans for solving and determine the assistance required from the Work Unit of the Soil Conservation Service. Do this to the satisfaction of the instructor and immediate supervisor.

Assistance is provided in the following areas and others: terraces, waterways (which involve stabilization structures and drain tiles), ponds, dry dams, surface drains, and contouring.

EE d. While working for the Soil Conservation Service and given prescribed record and report forms, fill in required information pertaining to time spent and progress accomplishments to standards prescribed by the Soil Conservation Service and with the accuracy and promptness demanded by the immediate supervisor.

EE e. While working for the Soil Conservation Service and given various written and verbal guidelines, maintain good working relationships with agency personnel, organizational leaders, contractors, and others while performing duties. Do to the satisfaction of supervisor.

Examples of duties are: preparing the application reports for district board meetings and attending regular meetings; assisting with gathering data and conducting tours, meetings, and demonstrations as scheduled in the district work plan and work unit annual plan of operation; gathering data for news releases and preparing drafts of news releases; assisting on county defense and radiological monitoring functions; assisting with training functions.

EE f. While working for the Soil Conservation Service and given equipment and machine check forms, make necessary checks and report to the supervisor the need for preventive maintenance and correction of any safety hazards at any place in the entire operation. Do this to the satisfaction of the instructor and immediate supervisor.

Examples of equipment and machines utilized in soil and water management for agricultural lands and public recreational areas are:

(1) Earthmoving -- grader, backhoe, scoop, and bulldozer

(2) Drainage -- ditching machines, subsoiler, and tile setter

(3) Irrigation -- overhead, aluminum tubing, plastic tubing, and pumps

(4) Powered outdoor recreation equipment -- outboard marine engines, snowmobiles, snow cats, golf carts, skilift equipment, snowmaking equipment, and hoists

(5) Specialized conservation and forestry equipment -- chain saws, skidding equipment, loaders, and scuba equipment

EE g. Pass a written examination with 90 percent accuracy on the job of a conservation technician. The questions and answers will be developed cooperatively by the instructor and Soil Conservation Service personnel.

Machinery repairman

The student will be able to:

EE a. Given the proper equipment, tools, and supplies, perform the common machinery repair jobs associated with arc welding, oxyacetylene welding, metal inert gas welding, tungsten inert gas welding, and soldering efficiently and safely to standards established by the publications listed in this section of the core course outline.

EE b. Given the proper equipment, tools, and supplies, perform the common machinery repair jobs associated with cold metal work, hot metal work, and woodworking efficiently and safely to standards established by the relevant publications listed in this section of the core course outline.

EE c. Given a hand tool which needs sharpening or fitting, recondition it efficiently and safely to the point where it is, for all practical purposes, as useful as when it was new. Do this to standards established by the relevant publications listed in this section of the core course outline.

EE d. Given a piece of equipment or a hand tool, be able to identify it correctly and explain its correct and safe use to standards established by the relevant publications listed in this section of the core course outline.

EE e. Pass a written examination with 90 percent accuracy on the job of a machinery repairman. The questions and answers will be

developed cooperatively by the instructor and a good machinery repairman with several years of experience.

EE f. Given any piece of equipment or a hand tool which a machinery repairman commonly uses, identify it by all the names it is known by and name all the principal parts as well. The standards established by the tool manufacturer and relevant publications listed in this section of the core course outline will be utilized in determining the accuracy of performance for this competency.

Agricultural structure erector

The student will be able to:

EE a. While working for an agriculture construction and maintenance business, given the proper manuals, written, and verbal directions -- and provided the components and tools needed -- construct (erect) either a part of or an entire structure. A grain-feed center is an example of such a structure. Do this to the standards established by appropriate engineering practices and specifications publications.

EE b. While working for an agriculture construction and maintenance business, given the proper manuals, written, and verbal directions -- determine the special safety shielding which must be fabricated and installed by either the dealer or the customer. Do this to the standards established by appropriate National Safety Council publications and professional publications which provide the required information about engineering practices and specifications.

Note: Materials-flow systems are generally built up on the farm. It is important that such equipment as this have safety shields to protect the operator. Since different manufacturers' equipment may be linked, it is impossible for them to prefabricate the needed shielding.

EE c. While working for an agriculture construction and maintenance business, given a problem or problems in special safety shielding, assist the personnel who will fabricate the shielding with a design for the shielding which will result in maximum convenience and safety. Do this to the satisfaction of the instructor, dealer, and customer.

EE d. While working for an agriculture construction and maintenance business, given specially designed safety shielding, install it in an efficient and safe manner. Do this to the satisfaction of the instructor and the dealer.

EE e. Pass a written examination with 90 percent accuracy on the job of an agriculture structure erector. The questions and answers will be developed cooperatively by the instructor and personnel from the agriculture construction and maintenance business.

Safety Technician -- Agricultural Electrification

The student will be able to:

EE a. Given the proper check sheets, correctly check the procedures used by electricians who install, repair, test and maintain electrical equipment and fixtures. Do this to the satisfaction of the instructor and local electrical inspector.

EE b. Given the National Electrical Code and local electrical code and proper test

equipment, inspect the completed electrical installations, repairs which have been made, and maintenance tasks which have been performed. Fill out the appropriate report forms to the satisfaction of the instructor and local electrical inspector.

EE c. Pass written and practical examinations with 90 percent accuracy. The written examination and practical performance examination will be devised by the instructor and local electrical inspector.

Examples of areas of knowledge necessary for the safety technician are: The Underwriters' Laboratories, The National Electrical Code, the local electrical code, electrical test instruments, Occupational Safety and Health Act Rules and Regulations, reading of electrical diagrams, and reading and understanding of technical literature.

CORE COURSE OUTLINE FOR AGRICULTURAL MECHANICS

Course Outline	Reference Code	Reference
III. Agricultural Mechanics		
A. Agricultural Power and Machinery		
1. Selection		
a. Tractor		
(1) Type	TR	Hunt, Donnell Farm Power and Machinery Management (1)
(2) Make and model		
(3) Convenience features	SR	Intertec Implement and Tractor Red Book (2)
(4) Nebraska Tractor Test results		
(5) Experience of other owners in community		
(6) Dealer services available	TR	ASAE Agr. Eng. Yearbook (3)
(7) American Society of Agricultural Engineers standards		
b. Small engines	SR	Owners' Manuals
(1) Type		
(2) Make and model		
(3) Convenience features		
(4) Experience of other owners in community		
(5) Dealer services available		
c. Implements and machines		
(1) Make and model	TR	Hunt, Donnell Farm Power and Machinery Management (1)
(2) Convenience features	SR	Hunt, Donnell Selection of Self-Propelled Combines (4)
(3) Experience of other owners in community	SR	V.A.S. 3021 The Planter--Selection, Adjustment, Maintenance, Use (5)
(4) Dealer services available	TR	ASAE Agr. Eng. Yearbook (3)
(5) American Society of Agricultural Engineers standards		FMO-172S Machinery Management (48a)

KEY: TR-TEACHER REFERENCE
SR-STUDENT REFERENCE

Course Outline	Reference Code	Reference
2. Operation		
a. Tractor		Owners' Manuals
(1) Importance of tractor safety	SR	
(2) Pre-operating procedures	SR	AAVIM Tractor Operation and Daily Care (6)
(3) Pre-operation adjustments to meet operating needs	TR	Center for Rural Manpower and Public Affairs, Michigan State Univ. Safe Tractor and Farm Machinery Operation (7)
(4) Starting and stopping the tractor engine	TR	V.A.S. Tractor Safety (4a)
(5) Controlling movement	TR	FMO-102S Tractors (44a)
(6) Hitching to tractor-operated equipment	SR	AAVIM Operating Tractors for Grounds Keeping and Ornamental Horticulture (8)
(7) Operating under field conditions	SR	V.A.S. 3013 Handling and Using Gasoline and Liquified Petroleum Gas (9)
(8) Operating under highway conditions	SR	AAVIM Selecting and Storing Fuels, and Lubricants (10)
(9) Unhitching equipment and stopping the tractor engine		
(10) Refueling, fuel storage and handling		
(11) Important safety practices		
(12) Testing procedures		
b. Small engines		Owners' Manuals
(1) Importance of safety	SR	V.A.S. 3014 Small Engines--Principles of Operation, Trouble Shooting and Tune-up (1)
(2) Safety practices common to all small engines	SR	
(3) Pre-operating procedures and adjustments for particular engine		AAVIM Care and Operation of Small Engines Volume I (12)
(4) Operating procedures for particular engine	SR	
(5) Special safety practices for particular engine and situation		
(6) Testing procedures		

Course Outline	Reference Code	Reference
c. Implements and machines		
(1) Importance of safety	SR	Owners' Manuals
(2) Safety practices common to all implements and machines	TR	Center for Rural Manpower and Public Affairs, Michigan State Univ., Safe Tractor and Farm Machinery Operation (7)
(3) Pre-operating procedures and adjustments for particular implement or machine	TR	FMO-182S Safety (45a)
	TR	FMO-152S Combine Harvesting (47a)
(4) Operating procedures for particular implement or machine	TR	V.A.S. 442 Calibrating Field Sprayers (1a)
	TR	V.A.S. 443 Calibrating a Granular Applicator (2a)
	TR	FMO-142S Hay and Forage Harvesting (51a)
(5) Special safety practices for particular implement or machine and situation	TR	FMO-112S Tillage (49a)
	TR	FMO-122S Planting (50a)
(6) Testing procedures	TR	V.A.S. 498 Using Power Lawn Mowers Safely (3a)

Examples of implements and machines important to Illinois agriculture are: moldboard plow, disc plow, disc harrow, spring-tooth harrow, grain drill, row crop planter, cultivator, rotary hoe, sprayer, duster, manure spreader, dry fertilizer distributor, liquid applicator, combine, corn picker, mower, rake, regular hay baler, bigroll hay baler, hay stacking wagon (loose hay), forage harvester, elevator, feed mill, feed grinder-mixer, crop drying equipment, forage blower, tractor-mounted loader, chain saw, feed distribution equipment, air compressor, power lawn mower.

3. How They Work and Maintenance

a. Tractor		
(1) Engine		
(a) Overview of operation	SR	AAVIM Tractor Maintenance Principles and Procedures (13)
(b) Basic engine		
(c) Gasoline fuel system	SR	John Deer FOS Engines (14)
(d) LP-Gas fuel system	TR	FOS-30 Slides Engines (54a)

Course Outline	Reference Code	Reference
(e) Diesel fuel system	TR	FOS-30 Masters Engines (58a)
(f) Intake and exhaust systems	TR	SX-1076 Film Clean Fuel (63a)
	TR	SX-1073 Film Clean Air (60a)
(g) Lubrication system	TR	SX-1075 Film Lubrication (62a)
(h) Cooling system	TR	SX-1974 Film Efficient Cooling (61a)
(i) Governing system	TR	VTR-72049 Set of 4 Videotape (64a)
(j) Electrical system	TR	FOS-20 Slides Electrical Systems (53a)
	TR	FOS-20 Masters Electrical Systems (57a)
(2) Power train		
(a) Overview of operation	SR	John Deere FOS Power Trains (15)
(b) Clutch	TR	FOS-40 Slides Power Trains (55a)
(c) Mechanical transmission	TR	FOS-40 Masters Power Trains (59a)
(d) Hydraulic assist transmission		
(e) Hydrostatic drive		
(f) Torque converter		
(g) Differential		
(h) Final drive		
(i) Power take-off		
(j) Special drive		
(3) Braking system		
(a) Overview of operation		
(b) Types		
(c) Maintenance		
(4) Steering system		
(a) Overview of operation		
(b) Types		
(c) Maintenance		
(5) Wheels and Tires		
(a) Construction	SR	V.A.S. 3031 Tires for Farm Equipment (16)
(b) Types of tires		
(c) Ply ratings, tire grades, tire sizes		
(d) Replacement		
(e) Storage		
(f) Inflation		

Course Outline	Reference Code	Reference
(g) Tire damage		
(h) Demounting and mounting		
(i) Reduction of slippage		
(j) Maintenance		
(k) Safety factors		
(6) Hydraulics	SR	John Deere FOS Hydraulics (17)
(a) Overview of operation and uses	TR	FOS-10 Slides Hydraulics (52a)
(b) Hydraulic pumps	TR	FOS-10 Masters Hydraulics (56a)
(c) Valves		
(d) Cylinders		
(e) Motors		
(f) Accumulators		
(g) Filters		
(h) Reservoirs, oil coolers, hoses, pipes, tubes, couplers		
(i) Seals		
(j) Fluids		
(k) General maintenance		
(7) Definitions of terms and related items		
(8) Safety precautions not previously covered		
b. Small engines		
(1) Two-cycle engine	SR	V.A.S. 3020 The Two-Cycle Engine (18)
(a) Operation		
(b) Carburetor		
(c) Spark plug		
(d) Maintenance		
(2) Two-cycle and four-cycle engines	SR	V.A.S. 3014 Small Engines--Principles of Operation, Troble Shooting and Tune-Up (11)
(a) Comparison		
(b) Operation		
(c) Carburetor		
(d) Spark plug		

Course Outline	Reference Code	Reference
c. Implements and machines	SR	John Deere FMO Preventive Maintenance (19)
	TR	FMO-162S Preventive Maintenance (46a)
(1) Moldboard plow	SR	Phipps, L.J. Mechanics in Agriculture (20)
(a) Overview of operation		
(b) Types		
(c) Draft		
(d) Component parts and what they do		
(e) Adjustments		
(f) Maintaining		
(2) Disc harrow	SR	Phipps, L.J. Mechanics in Agriculture (20)
(a) Overview of operation		
(b) Types		
(c) Component parts and what they do		
(d) Adjustments		
(e) Maintaining		
(3) Grain drill	SR	Phipps, L.J. Mechanics in Agriculture (20)
(a) Overview of operation		
(b) Types and sizes		
(c) Component parts and what they do		
(d) Adjustments and field checking		
(e) Maintaining		
(4) Cultivator	SR	Phipps, L.J. Mechanics in Agriculture (20)
(a) Overview of operation		
(b) Types: advantages and disadvantages of each		
(c) Ground-engaging equipment		
(d) Standards and frames		
(e) Attachments		
(f) Adjustments		
(g) Maintaining		
(5) Manure spreader	TR	Stone and Gulvin Machines for Power Farming (21)
(a) Overview of operation		
(b) Types and sizes		
(c) Box and framing		

Course Outline	Reference Code	Reference
(d) Conveyor mechanism		
(e) Beaters and beater drive		
(f) Chains		
(g) Maintaining		
(6) Combine	SR	John Deere FMO Combine Harvesting (22)
(a) Overview of operation		
(b) Types and sizes		
(c) Cutting and feeding: operations and adjustments		
(d) Threshing: operations and adjustments		
(e) Separating: operations and adjustments		
(f) Cleaning: operations and adjustments		
(g) Handling: operations and adjustments		
(h) Power system		
(i) Operating controls		
(j) Field adjustments		
(k) Maintaining		
(7) Regular pickup hay baler	SR	Phipps, L.J. Mechanics in Agriculture (20)
(a) Overview of operation		
(b) Types and sizes		
(c) Pickup mechanism		
(d) Feeding and compressing mechanisms		
(e) Tying mechanism		
(f) Power drive system		
(g) Chassis		
(h) Adjusting		
(i) Maintaining		
(8) Tractor-mounted loaders	TR	Stone and Gulvin Machines for Power Farming (21)
(a) Overview of operation		
(b) Types of loaders		
(c) Hydraulic system		

Course Outline	Reference Code	Reference
(d) Speed of operation		
(e) Buckets and booms		
(f) Frame and counterweights		
(g) Maintenance		
(9) Definition of terms and related items		
(10) Safety precautions not previously covered		
d. Cleaning and painting agricultural power units and implements and machines		
(1) Steam cleaner		
(2) De-greaser and power sprayer		
(3) Spray painting outfit	SR	V.A.S. 3015 Spray Painting (23)
	TR	V.A.S. Spray Painting (6a)

Note: An example from each of the following classifications of implements and machines was included in the core course outline: primary tillage, secondary tillage, planting, weed and insect control, fertilizer, grain harvester, hay harvester, and special.

4. Testing and Analysis		
a. Tractors		
(1) Testing and analyzing results for:		
(a) Intake system and exhaust system	SR	John Deere FOS Engines (14)
(b) Engine compression and cylinder leakage	SR	V.A.S. 3025 Engine Compression and Cylinder Leakage Testing (24)
(c) Engine oil pressure	SR	John Deere FOS Engines (14)
(d) Cooling system	SR	V.A.S. 3030 The Engine Cooling System (25)
(e) Battery	SR	V.A.S. 3024 The Storage Battery (26)
(f) Spark plugs	SR	V.A.S. 3026 The Spark Plug--Operation, Selection and Maintenance (27)
(g) Ignition system	SR	V.A.S. 3028 The Ignition System--Testing and Analyzing Test Results (28)
(h) Hydraulic system	SR	John Deere FOS Hydraulics (17)
(i) Tires	SR	V.A.S. 3031 Tires for Farm Equipment (16)
(j) Other	SR	John Deere FOS Engines (14), Electrical Systems (29), Hydraulics (17)

Course Outline	Reference Code	Reference
(2) Inspecting visually and using trouble shooting charts		
b. Small engines		
(1) Checking and analyzing results for:	SR	V.A.S. 3014 Small Engines--Principles of Operation, Trouble Shooting and Tune-Up (11
(a) Ignition		
(b) Carburetion	SR	Intertec Small Engines Service Manual (30)
(c) Compression		
(2) Inspecting visually and using trouble shooting procedures		
(3) Using micrometers and related measuring tools	SR	V.A.S. 3023 Micrometers and Related Measuring Tools (31)
c. Implements and Machines		
(1) Using check sheets for visual inspections		
(2) Using trouble shooting charts or related procedures for determining condition of system, component, or principal part of component		
d. Definitions of terms and related items		
e. Safety precautions		
5. Tune-Up and Repair	SR	AAVIM Farm Tractor Tune-Up and Service Specifications (32)
a. Tractors		
(1) Tune-up	SR	V.A.S. 3008 Farm Tractor Tune-UP (33)
(a) Follow tune-up schedule and detailed tune-up or special shop service manual as necessary	SR	John Deere FOS Engines (14), Electrical Systems (29), Hydraulics (17)
(2) Repair	TR	V.A.S. Tractor Tune-Up and Maintenance (5a)
(a) Follow repair instructions in the service manual or special shop service manual as necessary		

Course Outline	Reference Code	Reference
b. Small engines	SR	V.A.S. 3019 Small Engines--Repair and Overhaul (34)
(1) Tune-up	SR	AAVIM Maintenance and Repair of Small Engines Volume II (35)
(a) Follow tune-up directions in the service manual	SR	Intertec Small Engines Service Manual (30)
(2) Repair		
(a) Follow repair instructions in the service manual or special shop service manual as necessary		
c. Implements and Machines		
(1) Tune-up		
(a) In most instances, rather than a tune-up, a series of checks and adjustments will be made according to check sheets or similar forms furnished by the manufacturer in the owner's manual and service manual		
(2) Repair		
(a) Follow repair instructions in the service manual or special shop service manual as necessary		
d. Definitions of terms and related items		
e. Safety precautions		
6. Tool Identification, Use, and Safety	SR	General Motors ABC's of Hand Tools (36)
a. Tractor equipment and tools	SR	Broadhead Garrett Company Equipment and Supplies Catalog (37)
(1) Identification	SR	John Deere FOS Shop Tools (38)
(2) Use	SR	V.A.S. 3018 Air Compressors (39)
(3) Safety	SR	V.A.S. 3015 Spray Painting (23)
b. Small engines equipment and tools	SR	V.A.S. 3022 Safety in the Agricultural Mechanics Shop (40)
(1) Identification	SR	V.A.S. 3023 Micrometers and Related Measuring Tools (31)
(2) Use		Interstate Tool Identification Kit (41)
(3) Safety		
c. Implements and machines equipment and tools	SR	
(1) Identification		

Course Outline	Reference Code	Reference
(2) Use (3) Safety	SR	Interstate Machine Shop and Technology Tool Identification Kit (42)
7. Customer Relations a. Organization	SR	Collazzo Building Good Customer Relations (43)
b. Employee knowledge (1) Procedures and practices (2) Product	SR TR	Entenberg Are You Selling Enough Service? (44) Everett A Fistful of Future in 4 Easy Steps (45)
c. Why customers buy product or service		
d. Why customers don't buy product or service	TR	Ernest and DaVall Salesmanship Fundamentals (46)
e. Sales promotion	TR	Vreeland Customers, A Neglected Sales Force (47)
f. Building customer confidence (1) Parts (2) Code of ethics	SR SR	Otterbourg Building Customer Confidence in Your Service Shop (48) Manufacturers' manuals, parts catalogs, and price lists
B. Agricultural Structures and Conveniences		
1. Farmstead Planning a. Introduction (1) Goals (2) Essential (3) Making a plan (4) Farmstead plan vs. home plan	SR	Midwest Plan Service Farmstead Planning Handbook (49)
b. Developing the farmstead (1) Farmstead plan (2) Zone planning (3) Farmstead and main road		
c. Planning factors (1) Topography (2) Climate (3) Services		

Course Outline	Reference Code	Reference
d. Planning activity centers		
(1) Family living		
(2) Machinery storage, repair and service		
(3) Fuel, chemical and fertilizer storage		
(4) Grain storage and processing		
(5) Livestock production		
e. Planning services		
(1) Drives and parking		
(2) Wind and snow control		
(3) Sun		
(4) Soil freezing		
(5) Fire prevention and protection		
(6) Utilities		
(7) Safety		
(8) Security		
2. Farm Structures	SR	Midwest Plan Service Structures and Environment Handbook (50)
a. Materials		
(1) Wood		
(2) Lumber		
(3) Plywood		
(4) Nails		
(5) Gluing wood		
(6) Concrete		
(7) Galvanized steel	TR	V.A.S. 423 Selection and Application of Galvanized Roofing and Siding (7a)
(8) Paint		
b. Loads		
(1) Dead, snow, and wind		
(2) Floor and suspended		
(3) Imposed by stored products		
(4) Waste storage tanks		
c. Design		
(1) Lumber		
(2) Plywood		
(3) Wood girders and columns		

Course Outline	Reference Code	Reference
(4) Fasteners		
(5) Reinforced concrete		
(6) Truss design		
3. Construction, Remodeling and Repair		
a. Construction systems		
(1) Stud frame		
(2) Roof framing		
(3) Truss selection		
(4) Pole type construction		
(5) Arched rafters		
(6) Rigid frame		
(7) Tilt-up concrete		
(8) Concrete masonry		
b. Beam and column selection		
(1) Wood beams		
(2) Wood columns		
c. Concrete applications		
(1) Tanks		
(2) Slotted floors		
(3) Foundations		
d. Building with concrete masonry	SR	V.A.S. 3034 Building with Concrete Masonry (51)
(1) Laying out the building	TR	V.A.S. 439 Using the Level to Stake Out a Building Site (8a)
(2) Constructing footings	TR	V.A.S. 433 Planning and Preparing for Concrete Masonry Construction (10a)
(3) Mixing the mortar	TR	V.A.S. 434 Laying Concrete Masonry Units (11a)
(4) Laying the first course	TR	V.A.S. 435 Special Concrete Masonry Problems (12a)
(5) Laying block at corners		
(6) Building walls		
(7) Tooling mortar joints		
(8) Special masonry applications		

Course Outline	Reference Code	Reference
e. Making and using concrete on the farm (1) Selecting ingredients (2) Proportioning ingredients (3) Mixing concrete (4) Making, shaping, and bracing forms (5) Placing concrete (6) Finishing and curing concrete (7) Reinforcing concrete (8) Estimating materials and costs (9) Projects	SR	V.A.S. 3007 Making and Using Concrete on the Farm (52)
	TR	V.A.S. 432 The Use of Welded Wire Fabric on the Farm (9a)
	SR	Midwest Plan Service Structures and Environment Handbook (50)
f. Selecting and setting poles (1) Wood species (2) Wood quality (3) Preservative treatment (4) Identification markings (5) Dimensions (6) Round vs. sawn or slabbed poles (7) Depth of set (8) Stabilizing the pole		
g. Remodeling corn cribs for small grain storage (1) Strengthening stud-frame cribs (2) Strengthening pole cribs (3) Making a crib grain-tight (4) Making a crib weather-tight		
h. Applying asphalt roofing and siding products (1) Products available (2) Accessories needed (3) Amount of roofing needed (4) Choosing asphalt roofing material (5) Preparing deck for roofing (6) Applying strip shingles (7) Laying individual shingles	SR	V.A.S. 3035 Applying Asphalt Roofing and Siding Products (53)
	TR	V.A.S. Asphalt Roofing (14a)

Course Outline	Reference Code	Reference
(8) Applying interlocking shingles		
(9) Applying roll roofing		
(10) Applying asphalt siding		
(11) Wind hazard to roofing		
i. Exterior plywood in farm construction	SR	American Plywood Association Exterior Plywood in Farm Construction (54)
(1) Identification of species in plywood		
(2) Grades of plywood		
(3) Identification index and its relation to farm buildings		
(4) General recommendations		
(5) Grain storage construction applications		
(6) Siding for pole building construction		
(7) Other applications		
j. Painting and glazing		
(1) Selecting paints	SR	Jones Shopwork on the Farm (55)
(2) Preparing surfaces for painting		
(3) Applying paint		
(4) Using stains, varnishes, enamels and lacquers		
(5) Selecting, cleaning and caring for paint brushes		
(6) Painting with brushes		
(7) Spray painting	SR	V.A.S. 3015 Spray Painting (23)
(8) Painting failures and repainting	SR	Wakeman and McCoy, The Farm Shop (56)
(9) Storing and handling paints safely	SR	Jones Shopwork on the Farm (55)
(10) Glazing and repairing windows		
k. Carpentry		
(1) Cutting common rafters	SR	V.A.S. 3009 Use of the Square in Farm Construction (57)
(2) Building stairs and steps	SR	Wakeman and McCoy The Farm Shop (56)

Course Outline	Reference Code	Reference
(3) Laying out large stock (4) Safety (5) Other	SR	V.A.S. 3022 Safety in the Agricultural Mechanics Shop (40)
4. Plumbing		
a. Selecting equipment and supplies b. Measuring pipe	TR	V.A.S. 480 Identification of Pipe and Fittings (13a)
c. Cutting, reaming, threading and connecting	SR	Wakeman and McCoy The Farm Shop (56)
d. Protecting plumbing from freezing e. Repairing or replacing a leaky faucet f. Repairing toilet flush tank g. Cleaning out traps and drains h. Using cast iron soil pipe	TR	Manly, H.P. Plumbing Installation and Repair (58)
5. General--Agricultural Structures and Conveniences		
a. Building and plumbing codes and regulations b. Definitions of terms and related items c. Equipment and tool identification, use, and safety		
C-D. Soil and Water Management for Agricultural Lands and Public Recreational Areas		
1. Selection, Operation, How Equipment and Machinery Units Work, Maintenance, Testing and Analysis, Tune-Up and Repair, and Tool Identification, Use and Safety	SR SR SR	Owners' Manuals Service Manuals Special Shop Service Manuals
a. Earthmoving (1) Grader (2) Backhoe (3) Scoop (4) Bulldozer		

Course Outline	Reference Code	Reference
b. Drainage		
(1) Ditching machines		
(2) Subsoiler		
(3) Mole ditcher		
(4) Tile setter		
c. Irrigation		
(1) Overhead		
(2) Aluminum tubing		
(3) Plastic tubing		
(4) Pumps		
d. Powered outdoor recreation equipment		
(1) Outboard marine engines		
(2) Snowmobiles		
(3) Snow cats	SR	Intertec Snowmobile Service Manual (59)
(4) Golf carts		
(5) Skilift equipment		
(6) Snowmaking equipment		
(7) Hoists		
e. Specialized conservation and forestry equipment		
(1) Chain saws		
(2) Skidding eqiupment	SR	Intertec Chain Saw Service Manual (60)
(3) Loaders		
(4) Scuba equipment		
f. Terminology and nomenclature		
g. Safety precautions		
2. Agricultural Surveying and Land Descriptions		
a. Using the steel tape for determining distances	SR	V.A.S. 3010 Farm Surveying (61)
b. Measuring angles with the steel tape	TR	V.A.S. 436 Using the Steel Tape in Surveying (15a)

Course Outline	Reference Code	Reference
c. Using the steel tape in determining field areas		
d. Using the hand sighting level	TR	V.A.S. 438 Using the Level in Farm Surveying (17a)
e. Using the tripod level		
f. Differential leveling	TR	V.A.S. 437 Recording the Field Notes in Farm Surveying (16a)
g. Profile leveling		
h. Using profile surveys		
i. Staking out a building foundation		
j. Staking out a fence line		
k. Field problems		
l. Land descriptions (1) Why needed (2) Systems used in the United States (3) Exercises	SR	College of Agriculture, University of Illinois Legal Descriptions of Illinois Real Estate (62)
m. Terminology and nomenclature		
3. Terracing	SR	V.A.S. 4038 Terracing (63)
a. General		
b. Planning the system		
c. Staking terraces		
d. Constructing terraces		
e. Checking finished terraces		
f. Maintaining terraces		
g. Plowing terraced fields		
h. Preparing seedbed and planting crops on terraced land		
i. Harvesting crops on terraced land		
j. Nomenclature and terminology		

Course Outline	Reference Code	Reference
4. Grass Waterways	SR	V.A.S. 4021 Grass Waterways (64)
a. Water disposal		
b. Water course location		
c. Design		
d. Construction of water courses		
e. Sod chute		
5. Land Drainage	TR	Officials of Soil Conservation Service Drainage of Agricultural Land (65)
a. Effects and benefits		
b. Preliminary investigation of drainage jobs		
c. Drainage outlets		
d. Open outlet ditches		
e. Surface drainage		
f. Tile drainage		
g. Culverts		
h. Illinois farm drainage law	SR	College of Agriculture, University of Illinois Illinois Farm Drainage Law (66)
6. Farm Ponds	SR	Soil Conservation Service Ponds for Water Supply and Recreation (67)
a. Need for water		
b. Kinds of ponds		
c. Selecting the pond site	TR	Soil Conservation Service Illinois Engineering Practice, Standards and Specifications (68)
d. Preliminary site studies		
e. Estimating storm runoff		
f. Engineering surveys		
g. Embankment ponds		

Course Outline	Reference Code	Reference
h. Excavated ponds		
i. Sealing ponds		
j. Pond safety		
k. Terminology and nomenclature		
7. Estimating Costs	TR	Soil Conservation Service Illinois Engineering Practice, Standards and Specifications (68)
a. Agricultural surveying jobs		
b. Terracing jobs		
c. Grass waterways jobs		
d. Land drainage jobs		
e. Farm pond jobs		
E. Agricultural Mechanics Skills		
1. Planning, Equipping and Maintaining an Agricultural Shop	SR	Wakeman and McCoy The Farm Shop (56)
a. Purposes and values	SR	AAVIM Shop Planning--Basic Design of Shop and Service Centers (69)
b. Selecting the site		
c. Planning the building		
d. Selecting tools, equipment and supplies		
e. Arranging the interior and storing tools		
f. Storing materials and supplies		
g. Maintaining		
2. Making and Reading Sketches, Plans and Drawings	SR	Wakeman and McCoy The Farm Shop (56)
a. Purposes and values		
b. Making freehand sketches		

Course Outline	Reference Code	Reference
c. Reading and interpreting plans		
d. Basic procedures for mechanical drawing		
e. Making working drawings to scale		
f. Lettering		
g. Making out bill of materials		
h. Writing specifications to accompany drawings		
3. Arc Welding		
a. Development of shielded metal-arc welding	SR	V.A.S. 3004a Shielded Metal-Arc Welding (70)
b. Selecting equipment and supplies		
c. Safety precautions	TR	V.A.S. 470 Care and Maintenance of Arc Welding (30a)
d. Shielded metal-arc welding procedures	TR	V.A.S. 450-64 Arc Welding--Process, Equipment, and Safety (21a)
e. Out-of-position welding	TR	V.A.S. 451-64 Arc Welding--Flat Position Welding (22a)
f. Preparing metals for welding		
g. Cutting with arc welder	TR	V.A.S. 452-64 Arc Welding--Vertical, Horizontal and Overhead Position Welding (23a)
h. Special welding applications		
i. Hardsurfacing	TR	V.A.S. Shielded Metal-Arc Welding (33a)
j. Thawing frozen pipes		
k. Construction suggestions		
l. Using a carbon arc torch		

Course Outline	Reference Code	Reference
4. Oxyacetylene Welding	SR	V.A.S. 3001a Oxyacetylene Welding and Cutting (71)
a. Equipment needed		
b. Selecting equipment and supplies		
c. Setting up and testing equipment	TR	V.A.S. 454 Oxyacetylene--Assembling, Testing and Lighting Blowpipe (18a)
d. Lighting the blowpipe and adjusting the flame	TR	V.A.S. Gas Welding Safety (31a)
e. Safety precautions	TR	V.A.S. 455 Oxyacetylene--Cutting, Bronze Welding (19a)
f. Cutting with the oxyacetylene flame	TR	V.A.S. 456 Oxyacetylene--Fusion Welding, Hard Facing, etc. (20a)
g. Bronze welding		
h. Fusion welding		
i. Hard facing		
j. Using the oxyacetylene flame for forming, hardening and tempering		
k. Comparison of fuel gases		
5. Metal Inert Gas (MIG) Welding	SR	V.A.S. 3037 Metallic Inert Gas (MIG) Welding (72)
a. Reasons for popularity and explanation of process	TR	V.A.S. Inert Gas Welding (32a)
b. Equipment needed and how to set it up		
c. Steps in MIG welding and safety factors		
d. Welding of various metals		
e. Flux-cored wire welding		
f. Maintenance requirements, possible problems and solutions		
6. Tungsten Inert Gas (TIG) Welding	SR	V.A.S. 3036 Tungsten Inert Gas (TIG) Welding (73)
a. Reasons for popularity and explanation of process	TR	V.A.S. Inert Gas Welding (32a)

Course Outline	Reference Code	Reference
b. Equipment needed and how to set it up		
c. Techniques to be used and safety factors		
d. Welding of various metals		
e. Maintenance requirements		
f. Trouble shooting		
7. Soldering in Agriculture	SR	V.A.S. 3027 Soldering for Home, Farm and Shop Applications (74)
a. Soldering and the soldering process		
b. Tin-lead solders		
c. Soldering flux and flux action		
d. Sources of heating for soldering		
e. Soldering procedure		
f. Maintaining soldering coppers		
g. Silver soldering		
h. Installing sweat-type fittings		
i. Soldering stainless steel and aluminum		
j. Safety hazards connected with soldering		
k. Shop and laboratory applications		
8. Agricultural Metal Work	SR	V.A.S. 3002 Farm Metal Work (75)
a. Cold metal work	SR	Wakeman and McCoy The Farm Shop (56)
(1) Selecting and using layout tools		
(2) Safety precautions		
(3) Cutting cold metal		
(4) Smoothing metal		
(5) Making holes in metal		
(6) Cutting threads		
(7) Other cold metal operations		

Course Outline	Reference Code	Reference
b. Hot metal work (1) Identifying and naming principle parts of tools and equipment (2) Selecting tools and equipment (3) Using the coal forge and gas forge (4) Cutting mild steel (5) Bending mild steel (6) Upsetting mild steel (7) Drawing out mild steel (8) Punching mild steel (9) Annealing tool steel (10) Hardening and tempering tool steel (11) Safety precautions (12) Exercises and projects		
9. Tool Sharpening and Fitting	SR	V.A.S. 3005 Sharpening Hand Tools (76)
a. Safety precautions		
b. Identifying and naming principal parts, selecting and using grinders and sharpening stones		
c. Sharpening and fitting shop hand tools	SR	Wakeman and McCoy The Farm Shop (56)
d. Sharpening home, farm and gardening tools		
e. Replacing handles in tools		
f. Cleaning tools		
10. Woodworking--Hand and Power Tools	SR	Wakeman and McCoy The Farm Shop (56)
a. Selecting and caring for lumber	SR	McDonnell and others Hand Woodworking Tools (77)
b. Identifying and naming principal parts of hand and power tools and equipment	SR	Hammond and others Woodworking Technology (78)

Course Outline	Reference Code	Reference
c. Selecting and safely using hand and power tools and equipment for such things as:	SR	Stanley Tools Catalog (79)
(1) Measuring and marking wood	SR	V.A.S. 3022 Safety in the Agricultural Mechanics Shop (40)
(2) Sawing wood	SR	McDonnell and others Portable Power Tools (80)
(3) Planing and smoothing wood	TR	V.A.S. 460 The Jointer--How to Use It Safely (24a)
(4) Cutting wood with chisels	TR	V.A.S. 461 Drill Press--How to Use It Safely (25a)
(5) Boring and drilling holes in wood	TR	V.A.S. 462 The Circular Saw--How to Use It Safely (26a)
(6) Fastening	TR	V.A.S. 463 The Power Grinder--How to Use It Safely (27a)
(7) Shaping curved and irregular surfaces	TR	V.A.S. 464 The Radial Arm Saw--How to Use It Safely (28a)
d. Exercises and projects	TR	V.A.S. 465 The Portable Electric Saw--How to Use It Safely (29a)
Note: More advanced woodworking jobs are included under agricultural structures and conveniences.	TR	
F. Agricultural Construction and Maintenance		
1. Water Supply	SR	Midwest Plan Service Private Water Systems (81)
a. Quantity requirements		
b. Water sources	SR	AAVIM Planning an Individual Water System (82)
c. Pumps		
d. Pressure tanks		
e. Piping		
f. Water treatment		
g. Maintenance requirements		
h. Useful data		
i. State and local codes, rules and regulations	SR	Illinois Department of Public Health Illinois Water Pump Installation Code (83); Drilled Wells (84); Dug Wells (85)
j. Terminology and nomenclature		

Course Outline	Reference Code	Reference
2. Waste Disposal	SR	Midwest Plan Service Structures and Environment Handbook (51)
a. Domestic waste disposal	SR	Soil Conservation Service Soils and Septic Tanks (86)
b. Methods of handling animal wastes		
c. Oxidation ditch for treating hog wastes		
d. Anaerobic manure lagoons		
e. Slat and gutter construction		
f. Waste from milking plant		
g. Maintenance requirements		
h. State and local codes, rules and regulations		
i. Terminology and nomenclature		
3. Grain-Feed Handling	SR	Midwest Plan Service Planning Grain-Feed Handling (87)
a. Materials-flow concept		
b. Need for planning		
c. Closed loop handling		
d. Flow principles		
e. Matching components		
f. Farm materials flow		
g. Selecting a drying system		
h. System patterns		
i. Sketching and staking layouts		
j. Sizing flow rates		
k. Other aspects of grain-feed handling		
l. Terminology and nomenclature		

Course Outline	Reference Code	Reference
4. Estimating Costs		
a. Water supply systems		
b. Waste disposal systems		
c. Grain-feed handling systems		
G. Agricultural Electrification		
1. Electrical Hazards on the Farm	SR	V.A.S. 3012 Electrical Hazards on the Farm (88)
a. Factors contributing to electrical hazards		
b. Specific causes of farm electrical hazards		
c. Signs of an electrical crisis	SR	Anderson Electrical Tips for Everyone (89)
d. Grounding		
e. First aid treatment of electrical injuries		
f. Fighting electrical fires	TR	AAVIM Maintaining the Lighting and Wiring System (66a and 69a)
g. Circuit survey		
h. Farm electrical hazard checklist		
i. National Electrical Code and local electrical code	TR	National Fire Protection Association National Electrical Code (90)
j. Underwriters' Laboratories		
k. Lightning and lightning protection on the farm	SR	V.A.S. 3011 Lightning and Lightning Protection on the Farm (91)
l. Other information about lightning protection		

Course Outline	Reference Code	Reference
2. Planning for Electric Wiring	SR	V.A.S. 3011 Planning for Electrical Wiring (92)
a. General information	TR	V.A.S. 497 The Safe Use and Care of Ladders (42a)
b. Fundamentals of electricity	TR	AAVIM Understanding Electricity and Electrical Terms (65a and 68a)
c. Safety and adequacy	TR	V.A.S. 401-65 Diagramming Electrical Wiring Circuits (34a)
d. Planning the wiring system	TR	V.A.S. 404 Identification of Electric Wiring Items (35a)
e. Emergency power supply	SR	V.A.S. 3038 Using Three-Phase Electrical Power on the Farm (93)
f. Selecting wiring materials		
g. Using three-phase electrical power		
3. Electrical Wiring Procedures	SR	V.A.S. 3016a Electrical Wiring Procedures (94)
a. Electrical service	SR	Richter, H. P. Wiring Simplified (95)
b. Service entrance	TR	Richter, H. P. Practical Electrical Wiring (96)
c. Wiring techniques	TR	V.A.S. Wiring Exercises (43a)
d. Wiring electrical devices		
e. Electrical tools and supplies		
4. Applying Electrical Controls in Farm Production	SR	V.A.S. Applying Electrical Controls in Farm Production (97)
a. General overview	SR	Richter, H. P. Wiring Simplified (95)
b. Non-automatic control systems	TR	Richter, H. P. Practical Electrical Wiring (96)
c. Automatic control systems		
d. Combinations of sensing elements		
e. Terms and concepts		
f. Exercises		
5. Residential and Farm Electric Motors	SR	V.A.S. Electric Motors for Farm Use (98)
a. Importance	SR	Richter, H. P. Wiring Simplified (95)

Course Outline	Reference Code	Reference
b. How motors are rated	TR	Richter, H. P. Practical Electrical Wiring (96)
c. Nameplate information	SR	Anderson Electrical Tips for Everyone (89)
d. Starting capacity		
e. Overload capacity	TR	AAVIM Electric Motors, Selection--Protection--Drives (67a and 70a)
f. Power consumed by motors		
g. Speed of AC motors	TR	V.A.S. 412 Electric Motors Part 1 (36a)
h. Service factors on motors		
i. Split-phase motors	TR	V.A.S. 413 Electric Motors Part 2 (37a)
j. Capacitor motors		
k. Repulsion-start, induction-run motors	TR	V.A.S. 414 Electric Motors Part 3 (38a)
l. Other motors	TR	V.A.S. 415 Electric Motors Part 4 (39a)
m. Reversing motors		
n. Care of motors	TR	V.A.S. 416 Cleaning Electric Motors (40a)
	TR	V.A.S. 417 Practical Maintenance of Electric Motors (41a)

III. Agricultural Mechanics

A. Agricultural Power and Machinery

UNIT: 1. Selection

PROBLEM AREA: b. Small Engines

TEACHING PLAN

I. INTRODUCTION: A knowledge of engine nameplate information and small engine specifications can assist the agricultural mechanic in avoiding costly errors. The ability to make proper use of manufacturers' manuals, catalogs, and price lists will minimize frustrating, sometimes costly delays and mistakes, in getting the small engine back into service.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. When given engine blocks with manuracturers' nameplates on them, and the proper publications for providing essential information, determine the required information to 100 percent accuracy.

B. When given the problem of determining the clearance of engine parts and torque specifications of bolts, solve with 100 percent accuracy as determined by the publications provided.

C. When given the tasks of ordering replacement parts, and the proper publications for accomplishing this assignment, order with 100 percent accuracy.

D. Pass an examination in this problem area with 90 percent accuracy as determined by information from the publications studied.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Manufacturers' engine nameplates
   1. Model numbers
   2. Serial numbers
   3. Types of engines
   4. Types of crankshafts
   5. Types of starter systems used
   6. Types of bearings used
   7. Types of auxiliary power takeoff and speed reducers
   8. Major design changes
   9. Model variations

B. Manufacturers' specifications
   1. Clearance of engine parts
   2. Torque specifications of bolts

C. Parts catalogs
   1. Proper part nomenclature
   2. Part numbers
   3. Model numbers
   4. Parts interchangeability
   5. New parts listings
   6. Footnotes in the catalogs

D. Price sheets
   1. Comparing part numbers and pricing
   2. Learning prices
   3. Learning discounts

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Use engine blocks with manufacturers' nameplates attached to determine data mentioned under A, outline of instructional content.

B. Determine which engine parts have specific clearances listed for them, and list what those clearances are.

C. Determine which bolts have torque specifications listed for them, and list what those torque specifications are.

D. Select several parts for replacement. Look up necessary information for ordering. Write out an order for the parts on the order form provided.

E. Visit a dealer to determine how his parts department operates.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Several makes of four stroke cycle engines with nameplates on them.

B. Order Forms.

VI. STUDENT REFERENCES:

A. Manufacturers' manuals

B. Manufacturers' parts catalogs

C. Manufacturers' parts price lists

D. V.A.S. 3014 Small Engines--Principles of Operation, Trouble Shooting and Tune-Up

E. V.A.S. 3019 Small Engines--Repair and Overhaul

VII. TEACHER REFERENCES:

A. Turner, J. Howard and Smith, George Small Engines: Maintenance and Repair, Volume II. AAVIM, Engineering Center, University of Georgia, 30602

III. Agricultural Mechanics

A. Agricultural Power and Mechanics

UNIT: 7. Customer Relations

PROBLEM AREA: e. Sales Promotion

TEACHING PLAN

I. INTRODUCTION: Whenever it is necessary for an individual employed in an agricultural power and machinery dealership to meet customers on a regular and continuing basis, a significant amount of his personal chances for raises and promotions will depend upon how well he is able to understand and implement the principles of good customer relations.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass a written examination about customer relations with 90 percent accuracy. Accuracy will be determined by the instructor on the basis of the information provided by the publications listed at the end of this teaching plan.

B. Given an actual agricultural power and machinery sales situation, make a successful sales presentation. Success will be judged on the basis of the customer's reaction, professional salesman's opinion, and the number of items on a check sheet of sales fundamentals which the student accomplished.

C. Given an actual agricultural power and machinery customer complaint situation, solve the problem to the satisfaction of the customer according to the established policy of the dealership. Success will be judged on the basis of the customer's reaction, professional salesman's opinion, and the number of items on a check sheet of complaint solving principles which the student accomplished.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. The customer and the owner: customer is the boss
   1. Has choice of service centers
   2. Has money to pay for service
   3. Has influence with friends
   4. Can help create a good reputation

B. The customer
   1. Reasons for buying
      (a) Definite need for service product
      (b) Possible use for the produce or service
      (c) To add to wealth
      (d) To satisfy pride of ownership
      (e) To provide safety
      (f) To provide comfort
      (g) To provide profit
      (h) To provide pleasure
   2. Reasons for buying at a specific dealership
      (a) Good reputation of owner
      (b) Good reputation of serviceman
      (c) Cleanliness of shop
      (d) Personalities of employees
      (e) Morals of employees
      (f) Locality
      (g) Advertised products handled
      (h) Availability of parts
      (i) Fast service

C. The serviceman and the customer
   1. What the customer expects
      (a) Quality work and material
      (b) Honest answers to questions
      (c) Courteous treatment
      (d) Good service
      (e) Explanation of service needed
          (1) Fair repair costs
          (2) Fair replacement costs
      (f) Display of interest by the serviceman
      (g) Knowledge of the service by the serviceman
      (h) Presentable appearance
          (1) Clean uniform
          (2) Clean shave
          (3) Clean breath
          (4) Clean body
          (5) Acceptable haircut
          (6) Good habits
   2. Handling customer complaints
      (a) Getting customer away from other customers
      (b) Listening carefully
      (c) Keeping your temper
      (d) Customer safety
      (e) Restating the problem
      (f) Settling the complaint immediately according to established policy
      (g) Giving the customer the benefit of any doubt

D. Results of good customer relations
   1. Repeat service sales
   2. Sales to friends of customers
   3. Increased income for business

4. Possible increase in serviceman's salary
5. Assurance of steady employment

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students role play in good and bad examples of customer relations.

B. Have students relate personal experiences in customer relations.

C. Have demonstrations by instructor and/or resource person to show proper and improper methods of dealing with customers in typical and atypical situations, and class discussions after demonstrations.

D. Have students make sales presentations in actual dealership situations. Video tape for later playback in class.

E. Have students handle customer complaints in actual dealership situations. Video tape for later playback in class.

Note: Even if only one or two students get to perform in actual situations, a video tape recording for later playback and class discussion allows all to participate in a sense. A tape recorder can also be used with good results.

F. Have students observe a sales presentation by an experienced salesman or serviceman in an actual situation.

G. Have students observe an experienced serviceman handle actual customer complaints.

H. Show slidefilms "Salesmanship in Agricultural Business" and "Human Relations in Agricultural Business," and have class discuss how slidefilm information applies to customer relations in an agricultural power and machinery dealership.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Video tape machine

B. Tape recorder

C. Check sheets of sales fundamentals

D. Check sheets of complaint solving principles

E. Slidefilm projector

F. V.A.S. Slidefilm Number 391, "Salesmanship in Agricultural Business"

G. V.A.S. Slidefilm Number 392, "Human Relations in Agricultural Business"

VI. STUDENT REFERENCES:

A. Collazzo, Charles G. Building Good Customer Relations, Small Marketers Aid, Small Business Administration

B. Entenberg, Robert D. Are You Selling Enough Service? Small Marketers Aid, Small Business Administration

VII. TEACHER REFERENCES:

A. Everett, Ralph. A Fistful of Future in 4 Easy Steps, Empire Sales Training Center, Inc.

B. Ernest, John W. and DaVall, George M. Salesmanship Fundamentals, McGraw-Hill

C. Vreeland, Richard C. Customers, A Neglected Sales Force, Small Marketers Aid, Small Business Administration

III. Agricultural Mechanics

A. Agricultural Power and Machinery

UNIT: 3. How They Work and Maintenance

PROBLEM AREA: a. (Tractor Engine) Principal Parts, Functions, Related Information--Liquid Cooling System

TEACHING PLAN

I. INTRODUCTION: Meeting the performance objectives of this problem area will greatly increase the chances for success in ordering of replacement parts, efficient and safe operation of the tractor, and performance of the maintenance and repair jobs necessary for keeping the engine in good condition for an extended period of time.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Given any principal part of a tractor liquid cooling system, name it, explain its function, and supply related information. The standard of performance will be 100 percent for the naming of the part and explaining of its function and 90 percent for the supplying of related information as determined from the references listed at the end of this teaching plan.

B. Pass a written examination about this problem area with 90 percent accuracy. Accuracy will be determined by the instructor on the basis of approved answers obtained from the publications listed at the end of this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[1]

A. Names of principal parts of liquid cooling system
1. Radiator

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[1]Most of this outline from information found in publications listed under student references section.

2. Radiator pressure cap
3. Fan and fan belt
4. Coolant pump
5. Engine water jacket
6. Coolant filter
7. Thermostat
8. Connecting hoses
9. Coolant
10. Overflow pipe
11. Radiator shutters

B. Functions of principal parts
   1. Radiator
      (a) Provides a reservoir for enough liquid to operate the system
   2. Radiator pressure cap
      (a) Provides pressure control of the cooling system
      (b) A pressure valve in the cap allows steam to escape when the pressure reaches a certain point
      (c) The vacuum valve in the cap opens to prevent a vacuum in the cooling system when the system cools
   3. Fan and fan belt
      (a) The fan belt drives the fan
      (b) The fan forces cooling air through the radiator cores to more quickly dissipate the heat being carried by the coolant into the radiator
   4. Coolant pump (water pump)
      (a) Draws hot coolant from the engine block and forces it through the radiator for cooling
   5. Engine water jacket (engine coolant jacket)
      (a) Allows the coolant to flow around the cylinders and valves
   6. Coolant filter (water filter)
      (a) Keeps coolant clean
   7. Thermostat
      (a) Keeps engine from running too hot or too cold
      (b) Provides automatic control of engine temperature at the correct level
   8. Connecting hoses
      (a) Carry the coolant between cooling system components
   9. Coolant (water or antifreeze)
      (a) Absorbs heat and circulates freely to help prevent overheating of the engine and maintain the proper operating temperature
      (b) Carries heat from the engine water jacket into the radiator for transfer to the outside air

(1) Then flows back through the engine to absorb more heat

10. Overflow pipe
    (a) Provides a means of removing excess coolant and signals possible cooling system problems
11. Radiator shutters
    (a) Used in extremely cold weather so proper coolant operating temperature can be maintained

C. Related information
1. Radiator
    (a) Radiator capacity varies considerably according to make and model of tractor
        (1) Can be as small as 14 1/2 quarts or as much as 10 gallons, for example
    (b) Liquid is put in the top of the radiator and passes down through a series of small tubes surrounded by fins and air passages
    (c) Drain cocks are located at different places on the various makes and models of tractors
        (1) It is important to check their locations for the specific tractors being worked on
    (d) Some operator manuals recommend specific levels of coolant in radiators. Others are less definite
        (1) One manual may recommend one inch below the top of the radiator overflow pipe as the correct level
        (2) Another may recommend two and one-fourth inches below the top of the filler neck as being the correct level
        (3) The coolant should cover the baffle plates which are visible when the radiator cap is off
        (4) There must be room for expansion
2. Radiator pressure cap
    (a) Raises the boiling point of the coolant so the engine can operate at higher temperatures for better efficiency and with less boil over
    (b) Gasket must be in good condition
3. Fan and fan belt
    (a) Fan generally is driven by a V-belt from the engine crankshaft
    (b) Recommended deflections for the belt vary according to make and model of tractor

(1) Can be as small as 1/2" or as large as 1 1/4", for example

4. Coolant pump
   (a) Run by a belt
   (b) Belt arrangement varies according to make and model of tractor
   (c) Most pumps of newer tractors have self-lubricated, sealed ball bearings
5. Engine water jacket
   (a) Engine cylinder block and head both usually contain passages for coolant to flow around the cylinders and valves
      (1) Together they make up the water jacket
   (b) Water jacket holds only a small amount of the total coolant
      (1) This allows rapid engine warm-up--while the thermostat is closed
      (2) Makes for efficient cooling when the thermostat opens
   (c) As coolant is heated in the engine block, dissolved minerals separate out in solid form and coat the metal surfaces
      (1) The thicker this coating, the less heat is transferred from the engine to the coolant
      (2) Anti-rust compounds are important, and should be used to keep this from happening as much as would otherwise be the case
6. Coolant filter
   (a) Not all engines have
   (b) Has replaceable filter element
   (c) Dirt settles into sump at bottom of filter where it can be drained out periodically
7. Thermostat
   (a) Two types: bellows and bimetallic
   (b) Discard if broken or corroded
   (c) Should be of proper temperature and type for engine
   (d) Never use a high-temperature thermostat with an alcohol-base antifreeze
   (e) Never use a bellows thermostat in high-pressure cooling systems (9 pounds or higher)
8. Connecting hoses
   (a) Rubber hoses stand up to vibration better because they are flexible
   (b) Examine hoses at least twice a year for possible replacement or tightening
   (c) Use only the best hoses available
9. Coolant
   (a) For warm weather operation, soft water

with rust inhibitor is best from an economic point of view
(b) A good radiator sealer may be required at times
(c) For cold weather operation a permanent antifreeze (ethylene glycol) with rust inhibitor is required
(d) A good radiator sealer may be required at times for cold weather operation, just as for warm weather operation. Some antifreeze brands have a radiator sealer in the antifreeze
(e) Enough antifreeze must be added to the fresh soft water to withstand the lowest freezing temperature considered possible

10. Overflow pipe
(a) Must not be allowed to plug up

11. Radiator shutters
(a) Provided either as regular or as extra equipment

12. Other
(a) Too hot an engine can cause such things as pre-ignition, detonation, knock, burned pistons and valves, and lubrication failure
(b) Too cold an engine can cause extra wear, poor fuel economy, and accumulation of water and sludge in the crankcase

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students practice naming the principal parts of the liquid cooling system, explaining functions, and supplying related information.

B. Have a mechanic who is a specialist talk to the class about his experiences with the liquid cooling system. Allow time for him to answer students' questions.

C. Show students examples of worn out hoses and other components of the liquid cooling system. Bring out such things as:
1. A hose may look all right on the outside but be in bad condition on the inside.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Principal parts of liquid cooling system

B. Overhead projection slides of system and parts

C. 2 x 2 color slides of system and parts

D. Owners' manuals

E. Parts manuals

F. Tractors

G. Practice sets of questions, sketches, and pictures for use on an individual basis

VI. STUDENT REFERENCES:

A. V.A.S. 3030 The Engine Cooling System

B. Tractor Operation and Daily Care, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia 30602

C. Tractor Maintenance Principles and Procedures, AAVIM

VII. TEACHER REFERENCES:

A. John Deere Service Publicatons, Department F, John Deere Road, Moline, Illinois 61265
   1. Fundamentals of Service Engines
   2. Fundamentals of Machine Operation Preventive Maintenance

III. Agricultural Mechanics

B. Agricultural Structure and Conveniences

UNIT: 4. Plumbing

PROBLEM AREA: c. Identification, Principal Parts, Principles of Use, and Related Information--Tools for Measuring, Cutting, Reaming, Threading and Connecting Pipe

TEACHING PLAN

I. INTRODUCTION: In order to be an intelligent workman and achieve the satisfaction of performing pipe jobs well, it is helpful to be able to identify the tools, name the principal parts, explain principles of use, and list related information.

II. STUDENT PERFORMANCE OBJECTIVES:

A. Given any pipe tool included in this teaching plan, name it, list its principal parts, explain principles of use, and supply related information to 90 percent accuracy as established by the information in the references at the end of this teaching plan.

B. Pass a written examination about this problem area with 90 percent accuracy as determined by the instructor on the basis of approved answers obtained from the references listed at the end of this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[2]

A. Names of Tools and their principal parts
   1. Push-pull rule: case, rule (front and back), hook at end
   2. Three-corner (triangular) file: handle, tang, length, heel, point, face, edge, teeth
   3. Pipe cutter: handle, frame, steel rollers, tool steel wheel with a knife edge
   4. Hand hacksaw: handle, blade (teeth, heel, toe, sides), adjustable frame, rear attachment, front attachment, wing nut

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[2]Most of outline from information found in publications listed under student references and teacher reference section.

5. Burr reamer: bit stock shank, cutting teeth, point
6. Pipe stock: handles, set screws, spreading screw, die holder cover, guide (guiding collar)
7. Die: solid part, opening, teeth
8. Pipe vise: handle, frame, screw, movable jaw, stationary jaw and attachment plate, latch
9. Pipe wrench: handle, adjustment nut, stationary jaw, movable jaw

B. Principles of Use and related information
   1. Push-pull rule
      (a) Is spring loaded
      (b) Pulls out of case for use
      (c) Six foot length commonly used
      (d) Hook at end should be tight
      (e) First several inches usually graduated in thirty-seconds of inch, rest in sixteenths of inch
      (f) Steel blade (rule) is rigid enough for measuring straight surfaces, but is flexible enough for measuring some curved or irregular surfaces
      (g) Graduations on one side of blade only, but sometimes one edge is in inches and the other is in centimeters
      (h) Front of blade is the side with graduations
   2. Three-corner (triangular) file
      (a) Useful for marking pipe since mark won't come off
      (b) Useful for easy starting of hand hacksaw
      (c) Handle should always be on tang when using
      (d) Pressure should be on forward stroke only (when cutting). Use long, smooth, straight strokes
      (e) Keep teeth clean with file card and brush
      (f) Oil on file interferes with cutting action
          (1) Remove by chalking the file and brushing clean
      (g) Store files in separate holders
          (1) Teeth are brittle and dulled or broken files result from improper care
   3. Pipe cutter
      (a) Type with two steel rollers and one cutting wheel can be revolved completely around the pipe when cutting
      (b) A pipe cutter from 1/4 inch to 2 inches in size will handle most farm plumbing jobs
      (c) A pipe cutter will leave a burr on the the inner edge of the cut end of the pipe

(1) This burr reduces the inside diameter of the pipe at this point. It must be removed by reaming

4. Hand hacksaw
   (a) Enough pressure should be applied when cutting to prevent the blade from slipping or sliding
   (b) Cut only on the forward stroke
   (c) Lift on the return stroke just enough to clear the teeth from the bottom of the cut
   (d) Stand to one side in well balanced position and push straight through
      (1) Watch top of the frame to see the saw lines up properly for a straight cut
   (e) Injury can result from blade breaking
      (1) Can happen if there is too much bearing down pressure
      (2) Can happen if the blade is twisted rather than pushed straight
      (3) Can happen if the blade is not kept tight enough
   (f) At least two teeth should engage the work at all times
   (g) Don't start with a new blade in an old cut. Turn the metal to be sawed over and start new on the opposite side
   (h) Don't use cutting oil when cutting by hand
   (i) Don't try to sharpen hacksaw blade
      (1) Discard when it no longer will cut well enough
   (j) The number of teeth per inch is called pitch
   (k) The length of a blade is measured from the center of one hole to the center of the other hole
      (1) Lengths vary from 8 inches to 12 inches, generally
   (l) The width of the blade is from 7/16 of an inch to 1/2 inch
   (m) Blades are classified as all hard or flexible
      (1) Only the teeth are hardened on flexible blades
   (n) Don't try to cut too fast
5. Burr reamer
   (a) Removes burrs from inside wall of pipes
   (b) Common type has a bit-stock shank and is turned with a brace
   (c) One which reams all sizes of pipe from 1/4 inch to 2 inches is satisfactory for most farm plumbing jobs

(d) Not only does the burr reamer remove the burr from inside the wall of the pipe, it also leaves a slightly rounded opening

6. Pipe stock
   (a) Holds guide and die for threading pipe
   (b) The guide keeps the die cutting straight
   (c) Push hard on the stock as threading is started
      (1) After thread has caught, it is only necessary to turn the stock
7. Die
   (a) Must match the guide and stock
   (b) Always check to see the size stamped on the die and whether it cuts right or left (R or L)
      (1) Adjustable dies have proper alignment marks stamped on them
   (c) Keep die clean and free from iron chips or shavings
   (d) Apply threading-cutting oil at the start of the job and at about every third complete turn of the die
8. Pipe vise
   (a) Hinged pipe vise opens on one side to admit the pipe
      (1) Is provided with toothed jaws for clamping steel or iron pipe and with smooth friction jaws for holding brass or copper pipe
   (b) A vise that will hold all sizes of pipe from 1/8 inch to about 3 inches is satisfactory for most farm jobs
   (c) Is necessary for cutting, threading, and connecting fittings
9. Pipe wrench
   (a) Always designated by length
      (1) 6 inches to about 60 inches overall
   (b) Largest size needed for average plumbing jobs is 24 to 30 inches
   (c) Used for connecting pipe and round fittings
   (d) Adjustable or monkey wrench should be used in place of the pipe wrench on square and hexagon-shaped fittings to prevent marring

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students practice naming the tools and principal parts, explaining principles of use, and telling related information.

B. Have a local plumber talk to the class about plumbing tools and answer student and instructor's questions.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Tools listed under III A. Outline of Instructional Content, this problem area.

B. Overhead projector and transparencies

VI. STUDENT REFERENCES:

A. Wakeman, T. J. and McCoy, V. L. The Farm Shop

B. Phipps, Lloyd J. Mechanics in Agriculture

C. V.A.S. 3002, Farm Metal Work

VII. TEACHER REFERENCE:

A. Manly, H. P. (Technical Editor). Plumbing Installation and Repair

III. Agricultural Mechanics

B. Agruciltural Structures and Conveniences

UNIT: 4. Plumbing

PROBLEM AREA: c. Measuring, Cutting, Reaming, threading and connecting pipe

TEACHING PLAN

I. INTRODUCTION: Being able to measure, cut, ream, thread and connect pipe correctly is essential for the success of a significant number of plumbing jobs.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Given the proper pipe and tools, measure, cut, ream, thread and connect pipe efficiently and safely according to the information provided by the references at the end of this teaching plan.

B. Pass a written examination about this problem area with 90 percent accuracy. Accuracy will be determined by the instructor on the basis of approved answers obtained from the publications listed at the end of this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[3]

A. Measuring pipe
   1. Most pipe drawings show dimensions from the center of one fitting to the center of the next
   2. To determine the exact length of pipe to go between the fittings:
      (a) Use a table to find the distance the pipe screws into the fittings
      (b) Use a table to find the distance from the center to the end of each fitting
      (c) Use the dimensions obtained from the drawing and the tables to substitute into the following formula: length

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[3]Most of outline from information found in publications listed under student references section.

of pipe to go between the fittings equals the distance from center-to center of the fittings minus center-to-end of both fittings plus the distance the pipe screws into both fittings

(d) Problem and solution

(1) Problem: Given a distance of 24 inches from the center of one fitting to the center of the next on a drawing, determine the exact length a piece of 3/4 inch pipe should be if the center-to-end of each fitting is 1 5/16 inches and the 3/4 inch pipe screws into each fitting 1/2 inch

(2) Solution: 24 inches minus 2 5/8 inches plus 1 inch equals 22 3/8 inches

B. Cutting pipe with a pipe cutter

1. Place the pipe in the pipe vise with the mark far enough from the vise so the cutter will clear the work bench
2. Fit the pipe cutter over the pipe at the mark
   (a) Screw the handle in until the cutter wheel is pressing firmly (but not too firmly) against the pipe
3. Apply threading-cutting oil to the pipe and cutter wheel
4. Rotate the cutter one complete turn around the pipe
   (a) Then screw the handle in about a half turn
   (b) Continue the process until the pipe is cut through

C. Cutting pipe with a hand hack saw

1. Place the pipe in the pipe vise with the mark far enough from the vise so the hack saw will clear the work bench, but close enough to prevent chattering.
2. Be sure the blade is tightened firmly enough to prevent buckling during use
3. Grasp handle of saw with one hand and the opposite end of the frame with the other hand
4. File a small notch on the mark where the cut is to be made
   (a) Place saw in the notch and lightly press down as saw is drawn straight back
   (b) Apply light, even pressure on the forward stroke

(1) From this point on, do not apply pressure on the return stroke

(c) Continue to saw, applying pressure only on the forward stroke, until the pipe is cut through

(1) Use smooth motion, and use the entire length of the blade

(2) Avoid short, jerky strokes

(3) Do not use any sort of rocking motion, but follow straight through

D. Reaming pipe

1. Leave pipe in the vise after cutting it through with either a pipe cutter or hand hack saw

(a) Use a burr reamer to remove the burr left by the pipe cutter or hand hack saw

(b) Small pipe (1/8 inch to 3/8 inch) can be reamed more easily if it is cut with a hack saw

E. Threading pipe

1. Insert the proper-sized die and guide into the stock

2. Place the pipe in the vise

(a) The end of the pipe should project enough to allow the pipe stock to clear the work bench or vise stand

3. Fit the guide over the end of the pipe, and apply cutting oil to the pipe and die

4. Start the thread by turning the die slowly clockwise until the die begins to feed itself

5. Continue turning the stock slowly until the proper length of thread has been cut

(a) Apply threading-cutting oil about every third complete turn of the die

(b) Refer to a table for the proper length to cut the thread for the size of pipe being threaded

F. Connecting pipe with a pipe wrench

1. Adjust the wrench so it will grip the pipe near the back of the jaws

(a) Place the wrench on the pipe and apply pressure on the handle so the teeth will bite into the pipe

(1) It may be necessary to press the adjustable jaw firmly against the pipe with the other hand

2. Turn the handle in a clockwise direction for about a quarter turn. Keep fitting stationary

(a) The jaws should still be gripping the pipe well

3. Move the handle and jaws back to the starting position and repeat the turning movement
   (a) Continue a quarter of a turn at a time until the pipe is tight in the fitting
4. Pipe-joint compound ("pipe dope") should be applied to the threads to prevent leaking and rusting
   (a) Makes for easier disassembling if this becomes necessary, also

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students measure, cut, ream, thread and connect pieces of pipe as part of a shop exercise or project.

B. Have students solve several different problems relating to the exact length of pipe required for various applications.

V. SPECIAL MATERIALS AND EQUIPMENT

A. Measuring tape, push-pull rule, or other measuring device

B. Pipe cutter

C. Hand hacksaw

D. Burr reamer and brace

E. Soapstone marker or other marking device

F. Pipe stock and dies

G. Pipe vise

H. Bench or pipe vise stand

I. Pieces of pipe

J. Pipe fittings

K. Threading-cutting oil

L. Pipe wrenches

M. Three-corner file

VI. STUDENT REFERENCES:

A. Wakeman, T. J. and McCoy, V. L. The Farm Shop

B. Phipps, Lloyd J. Mechanics in Agriculture

C. V.A.S. 3002 Farm Metal Work

III. Agricultural Mechanics

C-D. Soil and Water Management for Agricultural Lands and Public Recreational Areas

UNIT: 6. Farm Ponds

PROBLEM AREA: i. Sealing Ponds

TEACHING PLAN

I. INTRODUCTION: Excessive seepage can cause ponds to fail. It is necessary to know principles of sealing ponds, materials to use for sealing, and other information to prevent costly mistakes in pond planning and construction.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from Agriculture Handbook Number 387, Ponds for Water Supply and Recreation.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[4]

A. Introduction
   1. Excessive seepage usually due to poor site selection
      (a) Soils in the impounding area too permeable to hold water
   2. If no satisfactory site is available, but need is great enough to have pond anyway
      (a) Plans for reducing seepage by sealing must be a part of the original pond design
   3. If excessive removal of soil mantle has occurred during construction, usually to provide material for embankment
      (a) Highly pervious material such as sand, gravel, or rock containing cracks, crevices, or channels may become exposed
      (b) More careful selection of embankment material would probably have avoided this problem

[4]Most of outline from information found in publications listed under student reference and teacher references sections.

(1) Once problem appears, however, permeability of the impounding area must be reduced to tolerable levels

B. Methods for reducing permeability of pond areas
1. Compaction
(a) Least expensive method of those presented here
(b) Depends on material containing a wide range of particle sizes--small gravel or coarse to fine sand, enough clay (usually 10 percent or more), and silt to effect a seal
(c) Where 10 feet or less of water is to be impounded
(1) Clear the pond area of all trees and other vegetation
(2) Fill all stump holes, crevices, and similar areas with impervious material
(3) Scarify the soil to a depth of 8 to 10 inches with a disk, rototiller, pulverizer, or similar equipment
(4) Remove all rocks and tree roots
(5) Roll the loosened soil under optimum moisture conditions to a dense, tight layer with four to six passes of a sheepsfoot roller in the same manner as for compacting earth embankments
(6) Make the compacted seal not less than 8 inches thick
(d) Where more than 10 feet of water is to be impounded
(1) Increase the thickness of the compacted seal proportionately
(2) Compact the soil in two or more layers not exceeding 8 inches each over that section of the pond where the water depth exceeds 10 feet
(3) Remove and stockpile the top layer or layers while the bottom layer is being compacted
2. Clay blankets
(a) Used where pond areas contain high percentage of coarse grained soils and lack enough clay to prevent excessive seepage
(b) Blanket the entire area over which water is to be impounded as well as the upstream slope of the embankment
(1) Blanket should consist of well graded coarse-grained material containing at least 20 percent clay

(2) Requirements for good blanket material are about the same as those described for earth embankments
(3) Usually material can be obtained from a borrow area close enough to permit hauling at a reasonable cost

(c) Minimum thickness of blanket is 12 inches for all depths of water up to 10 feet
(1) Increase this thickness by 2 inches for each foot of water over 10 feet

(d) Construction
(1) Remove all trees and other vegetation and fill all holes and crevices before hauling earth material from the borrow area to the pond site in tractor-pulled wheeled scrapers or similar equipment
(2) Spread the material uniformly over the area in layers 6 to 8 inches thick. Compact each layer thoroughly
(a) Do under optimum moisture conditions
(b) Make 4 to 6 passes with a sheepsfoot roller before placing the next layer
(3) Protect clay blankets against cracking that results from drying and against rupture caused by freezing and thawing
(a) Spread a cover of gravel, 12 to 18 inches thick, over the blanket below the anticipated high water level
(b) Use rock riprap to protect areas where the waterflow into the pond is concentrated

3. Bentonite
(a) Bentonite is a fine-textured colloidal clay
(1) When wet, it absorbs several times its own weight of water
(2) At complete saturation, it swells as much as 8 to 20 times its original volume

(b) Mixed in the correct proportions with well-graded coarse-grained material, thoroughly compacted, and then saturated, the particles of bentonite swell until they fill the pores to the point the mixture is nearly impervious to water
(1) On drying, bentonite returns to its original volume leaving cracks

(2) Sealing with bentonite usually is not recommended for ponds in which the water level is expected to fluctuate widely
(3) A laboratory analysis of the pond area material to determine the rate of application is essential

(c) Before selecting this method of sealing a pond, locate the nearest satisfactory source of bentonite and investigate the freight rates
(1) If source is too far away, the cost may be too high to use bentonite

(d) Construction
(1) Initial steps same as for previous methods: clearing pond area of all vegetation, etc.
(2) Moisture level should be optimum for good compaction
(3) Spread the bentonite carefully and uniformly over the area to be treated at the rate determined by laboratory analysis
(4) Thoroughly mix the bentonite with the surface soil to a depth of at least 6 inches
(a) Rate quite often is 1 to 3 pounds per square foot of area
(b) Rototiller is best for this operation
(c) Compact the area with four to six passes of a sheepsfoot roller

(e) If considerable time is to go by between applying bentonite and filling the pond, protect against drying and cracking
(1) A mulch of straw pinned to the surface by the final passes of the sheepsfoot roller works well
(2) Use rock riprap to protect areas where water inflow into the treated area is concentrated

4. Chemical additives
(a) Chemical treatment is not effective in coarse-grained soils
(1) Soils in the pond area should contain more than 50 percent fine-grained material (silt and clay) and at least 15 percent clay for chemical treatment to work
(2) Tetrasodium pyrophosphate and sodium tripolyphosphate are quite effective
(a) Sodium chloride (common salt) also commonly used

(3) A laboratory analysis of the soil in the pond area is essential to determine which dispersing agent (chemical) will be most effective and to determine the rate at which it will be applied

(b) Construction

(1) Similar steps as for other methods plus:

(a) Cover rock outcrops and other exposed areas of highly permeable material with 2 or 3 feet of fine-grained material
--Thoroughly compact

(b) Dispersing agent can be applied with a seeder, drill, fertilizer spreader, or by hand broadcasting
--Dispersant should be finely granular with at least 95 percent passing a No. 30 sieve and less than 5 percent passing a No. 100 sieve
--Operating mixing equipment in two directions produces best results

(c) Protect against puncturing by livestock

(d) Cover the area near the high-water mark line with 12- to 18-inch blanket of gravel to protect against erosion

(e) Use riprap on areas where inflow into the pond is concentrated

5. Waterproof linings

(a) Polyethylene, vinyl, and butyl-rubber membranes are gaining wide acceptance

(b) All plastic membranes should have a cover of earth or earth and gravel not less than 6 inches thick to protect against punctures

(c) Butyl-rubber membranes need not be covered except in areas traveled by livestock

(1) In these areas a minimum of 9 inches should be used on all types of flexible membranes

(a) The bottom 3 inches of cover should be no coarser than silty sand

(d) Follow recommendations of manufacturer and distributor for particular flexible membrane to be used

(e) Some plants, such as nutgrass, johnsongrass, and quackgrass may need to be sterilized with a good chemical sterilizer

(f) A proper anchor trench is a necessity

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have a conservationist and a pond contractor talk to the class and answer questions afterward.

B. Visit a pond site where a pond is under construction and discuss experience upon return to school.

C. Visit a pond which has been built sometime ago to see how it is working. Have owner tell of his experiences with the pond and answer questions.

D. Build a pond as part of a school nature area or other area which would be benefited by a pond.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. 2 x 2 color slides and equipment for showing

B. Overhead transparencies and overhead projector

C. Samples of various materials used for sealing ponds

VI. STUDENT REFERENCE:

A. Agriculture Handbook No. 387, Soil Conservation Service Ponds for Water Supply and Recreation

VII. TEACHER REFERENCES:

A. Illinois Engineering Practice Standards and Specifications for Conservation Practices
   1. Farm ponds
   2. Pond Sealing or Lining--Flexible Membrane
   3. Pond Sealing or Lining--Soil Dispersant
   4. Pond Sealing or Lining--Bentonite

III. Agricultural Mechanics

C-D. Soil Water Management for Agricultural Lands and Public Recreational areas

UNIT: 6. Farm Ponds

PROBLEM AREA: c. Selection of Pond Sight--Protecting and Maintaining the Pond

TEACHING PLAN

I. INTRODUCTION: Ponds which are not properly protected and maintained are short-lived. They represent large investments which should be protected.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from Agriculture Handbook Number 387, Ponds for Water Supply and Recreation.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[5]

A. Protecting the pond against erosion
   1. Establish a good cover of sod-forming grasses on the exposed surfaces of the dam, the spillway, borrow areas, and other disturbed areas
      (a) Grade the banks or side slopes of borrow pits to a uniform slope that permits easy mowing, preferably no steeper than 4:1
   2. Mulching new seeded areas with a thin layer of straw or a manufactured material may be desirable
   3. Some sodding of problem surfaces may be necessary

B. Protecting upstream face of a dam against wave action

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[5]Most of outline from information found in publications listed under student reference and teacher references sections.

1. Berms
   (a) If the water level in the pond is expected to remain fairly constant, a berm 8 to 10 feet wide located at normal pool level usually gives adequate protection
   (b) Berm should have a transverse slope of about 6 to 12 inches toward the centerline of the dam
   (c) Slope above the berm should be protected by vegetation
2. Booms
   (a) Using log booms is another way of breaking up wave action
   (b) A boom consists of a single or double line of logs chained or cabled together and anchored to each end of the dam
      (1) Tie the logs end to end as close together as practicable
      (2) Leave enough slack in the line to allow the boom to adjust to fluctuating water levels
   (c) For best results place the boom so it floats about 6 feet upstream from the face of the dam
   (d) Booms are most satisfactory for small structures
3. Rock riprap
   (a) An effective method for ponds in which the water level fluctuates widely or if a high degree of protection is required
      (1) Riprap should extend from the top of the dam down the upstream face to a level at least 3 feet below the lowest anticipated water level
   (b) Riprap is dumped directly from trucks or other vehicles or is placed by hand
      (1) Hand placing gives more effective protection and requires less stone
      (2) Dumping requires more stone but less labor
   (c) Layer of stones should be at least 12 inches thick and must be placed on a bed of gravel or crushed stone at least 10 inches thick
      (1) The bed keeps the waves from washing out the underlying embankment material that supports the riprap
   (d) If riprap is not continuous to the upstream toe, provide a berm on the upstream face to support the layer of

riprap and to keep it from sliding down-slope

C. Protecting the pond against livestock
   1. Complete fencing of areas on which embankment ponds are built is usually recommended if livestock are grazed or fed in adjacent fields
      (a) Fencing provides protection needed to develop and maintain a good plant cover on the dam, the earth spillway and other areas
      (b) Fencing provides clean drinking water and eliminates contamination or damage by livestock
      (c) Fencing helps establish an environment beneficial to wildlife
   2. A gravity-fed watering trough for livestock can be installed just below the dam and outside the fenced area

D. Maintaining the pond
   1. Inspection and repair
      (a) Examine after heavy rains to determine whether it needs minor repairs
         (1) Such damage must not be neglected
      (b) Fill any rills on the side slopes of the dam and any washes in the spillway immediately with suitable material and compact it thoroughly
         (1) Reseed or resod these areas and fertilize immediately as appropriate
      (c) If the upstream face of the earthfill shows signs of serious washing or sloughing because of wave action, install protective devices such as booms or riprap
      (d) If there is evidence of seepage through or under the dam, consult an engineer at once
         (1) Proper corrective measures must be taken before there is any serious damage
      (e) Maintain the protective plant cover on the dam and earth spillway by mowing and fertilizing as needed
         (1) Mowing prevents the growth of woody plants and helps develop a cover and root system more resistant to runoff
      (f) Keep fences in good repair, if plant cover is protected by fences
      (g) Keep trickle tubes, trash racks, outlet structures, valves, and watering troughs free of trash at all times

(h) Control burrowing animals such as badgers, gophers, etc., by trapping
(1) A heavy layer of sand or gravel on the fill discourages burrowing to some extent
(2) Poultry netting can be used, but in time will need to be replaced

2. Sanitation
(a) Keep the water in the pond as clean and unpolluted as possible
(1) Do not permit unnecessary tramping by livestock, especially hogs
(2) If fencing is not practical, pave the approaches to the pond with small rocks or gravel
(3) Divert drainage from barn lots, feeding yards, bedding grounds, or any other source of contamination from the pond
(b) Make the pond as attractive as possible
(c) Clean water is especially important in ponds from which ice is to be harvested, in those where wildlife is to be harbored, and in those used for recreation

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Visit a pond which has been built for some time and see how well it has been maintained and protected.

B. Have an engineer speak to the class about problems which he has solved which relate to pond protection and maintenance.

C. Have a pond owner speak to the class about pond protection and maintenance.

D. Have a conservationist speak to the class about pond protection and maintenance.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. 2 x 2 color slides and equipment for showing

B. Overhead transparencies and overhead projector

C. Samples of manufactured material which is used for mulching newly seeded areas

VI. STUDENT REFERENCE:

A. Agriculture Handbook No. 387, Soil Conservation Service Ponds for Water Supply and Recreation

VII. TEACHER REFERENCES:

A. Illinois Engineering Practice Standards and Specifications for Conservation Practices
   1. Farm Ponds
      (a) General
      (b) Embankment Ponds
      (c) Excavated Ponds

III. Agricultural Mechanics

E. Agricultural Mechanics Skills

UNIT: 10. Woodworking--Hand and Power Tools

PROBLEM AREA: c. Identifying and Naming Principal Parts of Hand Woodworking Tools used for Measuring and Layout

TEACHING PLAN

I. INTRODUCTION: One sign of a good workman is the knowledge he has of the tools available for use in the jobs he is expected to perform. This is basic to intelligent tool selection, and there are many situations where it is either necessary or desirable to receive or give instruction in tool use. Communication is important. A person who knows the "language of tools" is able to communicate much more effectively than one who doesn't.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Identify and name the principal parts of each hand woodworking tool used for measuring and layout to 100 percent accuracy as determined by the information included in this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Measuring tools
   1. Steel tape, 50 feet and more
      (a) Case
      (b) Folding handle
      (c) Tape with graduations
      (d) Ring
      (e) Hook
   2. Push-pull rule, 6 feet and more
      (a) Case
      (b) Tape with graduations
      (c) Hook
   3. Zig-zag folding rule, hardwood or aluminum, 3 feet and more
      (a) Sections with graduations
      (b) Spring joints

(c) Brass slide which may be extended for taking inside measurements or removed completely to measure the depth of holes (not all zig-zag folding rules have)

4. Folding rule, 2 feet or 3 feet, each with four folds
   (a) Sections with graduations on both faces
   (b) Main knuckle
   (c) Joints
   (d) Brass binding
5. Bench rule, wood or aluminum, 2 feet
   (a) Hardwood rule has brass cap on each end
   (b) Both have graduations on both faces

B. Layout tools
1. Carpenter's square (also known as framing square or steel square)
   (a) Tongue (16 inches or 18 inches
   (b) Body (24 inches)
   (c) Heel
   (d) Graduations on face and back of square
   (e) Rafter and framing table on face side of body
   (f) Octagon scale on face side of tongue
   (g) Essex board measure table on back side of body
   (h) Brace measure table on back side of tongue
   (i) Face side is side with trademark
2. Wood marking gauge (about 8 inch beam)
   (a) Head
   (b) Face
   (c) Plate
   (d) Pin
   (e) Shoe
   (f) Thumb screw
   (g) Beam
   (h) Stop screw
3. Try square with either metal handle or wood handle (4 inches or more in length)
   (a) Handle
   (b) Blade (graduations on both sides)

   There is also a try and miter square with similar parts.
4. Combination square (12 inch blade is most common)
   (a) Head
   (b) Blade
   (c) Scriber
   (d) Bubble or spirit level
   (e) Nut
   (f) Spring
   (g) Pin with notch

   Graduations on both sides of blade. Three types of heads: square-and-miter, center, bevel protractor

5. Sliding T-bevel (12 inch blade most common)
   (a) Handle (slotted). Made either of wood or metal
   (b) Blade (slotted). No graudations either side
   (c) Blade clamping screw
6. Spring dividers (most common sizes 6, 8 and 10 inches)
   (a) Handle
   (b) Spring
   (c) Legs with points
   (d) Leg positioner
7. Wing dividers
   (a) Micrometer
   (b) Thumbscrew for holding legs a certain distance apart
   (c) Thumb nut for micrometer adjustment
   (d) Legs
   (e) Clamp for fastening a pencil or scriber to divider leg
8. Firm joint divider
   (a) Legs (two--one fitted to hold a short pencil, and the other fitted with an adjustable steel point)
   (b) Wingnut at joint (spaces legs and tightens in position)
9. Trammel points
   (a) Beam (to which thumbscrews and points are attached)
   (b) Clamping device for pencil on one of the two trammel points
10. Layout (string) lines, about 200 feet long
   (a) Attached to a stick or reel by winding as a kite string might be wound
11. Chalk line, about 50 feet in length (self chalking one is most convenient)
   (a) Line with ring at end
   (b) Case for line (there is a well of chalk dust within the case)
   (c) Handle on case for reeling in the line

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students practice identifying hand woodworking tools used for measuring and layout, and naming their principal parts.

V. SPECIAL MATERIAL AND EQUIPMENT:

A. Overhead transparencies and overhead projector

VI. STUDENT REFERENCES:

A. Brodhead-Garrett Company Equipment and Supplies Catalog, 4560 East 71st Street, Cleveland, Ohio

B. Hammond, James J., Donnelly, Edward T., Harrod, Walter F., Rayner, Norman A. Woodworking Technology, McKnight and McKnight Publishing Company, Bloomington, Illinois

C. McDonnell, Leo P., Kidd, Donald M., Siy, Louis J. Hand Woodworking Tools, Delmar Publishers, Inc., Albany, New York

D. Stanley Tools Catalog, Stanley Tools Division of the Stanley Works, New Britain, Connecticut

III. Agricultural Mechanics

E. Agricultural Mechanics Skills

UNIT: 10. Woodworking--Hand and Power Tools

PROBLEM AREA: b. Identifying and Naming Principal Parts of the Following Classifications of Hand Woodworking Tools: Saws, Planes and other Edge Cutting Tools, Wood Chisels, Hatchets

TEACHING PLAN

I. INTRODUCTION: The good workman is able to identify the tools which he uses and name their principal parts. The careless workman does not pay much attention to these and other details. Pride of workmanship is indicated by a person's willingness to pay attention to the hundreds of details necessary for achieving success. Knowledge of tools is one of the important details.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Identify and name the principal parts of each hand woodworking tool included in this teaching plan to 100 percent accuracy as determined by the information included in this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:

A. Saws
   1. Hand crosscut saw (24 inches is handy length)
      (a) Handle
      (b) Blade
      (c) Teeth (popular fineness of cut from 8 points per inch to 11 points per inch)
      (d) Back
      (e) Toe
      (f) Heel

      Nomenclature is the same for hand ripsaw. For ripsaw fineness of cut the choice generally is from 5 1/2 to 7 points per inch
   2. Hand ripsaw
   3. Compass saw (12 to 14 inches are popular lengths)
      (a) Handle (has slot for the blade to fit into)
      (b) Blade (narrow and tapered for cutting curves)
      (c) Teeth (fine rip teeth)
      (d) Back

(e) Toe
(f) Heel (blade is slotted above the heel so it can fit into the slot on the handle)
(g) Wingnut or screw to keep handle tight (may be two)

4. Keyhole saw
   (a) Is a bit shorter than compass saw, is narrower at the handle, has finer teeth, and tapers to a sharper point. Nomenclature is the same
5. Coping saw (popular size is one with inside measurement of frame 4 3/4 inches by 6 3/4 inches)
   (a) Handle
   (b) Frame
   (c) Blade (narrow with tiny rip teeth. Held in frame under tension)
   (d) Front blade attachment
   (e) Rear blade attachment

   Blade is detachable
6. Back saw (12 and 14 inches are popular lengths)
   (a) Handle
   (b) Blade
   (c) Teeth (fine crosscut)
   (d) Back (reinforced)
   (e) Toe
   (f) Heel

   A longer and wider back saw, known as the miter saw, is used in a metal miter box
7. Miter box
   (a) Saw guides
   (b) Depth stop
   (c) Width of board adjustment
   (d) Frame
   (e) Quadrant
   (f) Saw guide catches
   (g) Legs
   (h) Lock lever
   (i) Baseboard
   (j) Adjustable length stop
   (k) Front guidepost
   (l) Rear guidepost
   (m) Screw at bottom of post
   (n) Setscrew at top of post

B. Planes and other edge cutting tools
1. Smooth plane (7 to 10 inches long)
   (a) Knob
   (b) Lever cap screw
   (c) Plane iron cap
   (d) Lever cap
   (e) Cam
   (f) Double plane iron
   (g) Single plane iron

(h) Lateral adjusting lever
(i) Handle
(j) Heel
(k) Adjusting nut
(l) Throat
(m) Frog
(n) Frog screw
(o) Frog adjusting screw
(p) "Y" adjusting lever
(q) Handle screw
(r) Handle bolt and nut
(s) Lever cap screw
(t) Cap screw

Nomenclature for jack plane, jointer plane, and fore plane same as for smooth plane.

2. Jack plane (11 1/2 to 15 inches long)
3. Jointer plane (22 to 24 inches long)
4. Fore plane (18 inches long)
5. Block plane (from 4 to 7 inches in length)
   (a) Toe
   (b) Finger rest
   (c) Lever cap screw
   (d) Adjusting screw
   (e) Plane iron
   (f) Heel
   (g) Throat
6. Spoke shave (either a 9 or 10 inch frame)
   (a) Frame
   (b) Blade
   (c) Cutter cap
   (d) Cap screw
   (e) Adjusting screws
7. Drawknife (has a cutting blade from 8 to 10 inches long)
   (a) Frame (U-shaped)
   (b) Blade
   (c) Handles (one at each end of frame. Made of wood)
8. Cabinet scraper (has 11 1/2 inch frame)
   (a) Frame
   (b) Blade
9. Hook scraper (blade widths range from 1 1/2 inches to 3 inches, and length of handles from 5 inches to 12 inches)
   (a) Frame (either metal or hardwood)
   (b) Blade

C. Wood chisels
   1. Butt chisels (from 2 1/2 inches to 3 1/4 inches -- length of blades)
      (a) Cutting edge
      (b) Bevel
      (c) Blade
      (d) Handle
      (e) Head

2. Pocket chisels (from 3 1/4 inches to 4 1/2 inches -- length of blades)
3. Firmer chisels (from 4 1/2 inches to 7 inches -- length of blades)
4. Widths of blades are from 1/8 inch to 2 inches for all
5. Nomenclature is the same for all. There are, however, two main types of chisels: tang or socket. In the tang type, the chisel fits into the handle. In the socket type, the handle fits into a socket on the wood chisel.

D. Hatchets
1. Adze eye
2. Cheeks
3. Head
4. Handle
5. Bevel
6. Cutting edge
7. Claw (in case of claw hatchet)

Half hatchet and lathing hatchet each has nail pulling slot. Lathing hatchet has a double bevel edge. Claw hatchet and half hatchet each may be obtained with either a single or double bevel cutting edge.

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have students practice identifying hand woodworking tools included in this teaching plan and naming their principal parts.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Overhead transparencies and overhead projector

VI. STUDENT REFERENCES:

A. Brodhead-Garrett Company Equipment and Supplies Catalog, 4560 East 71st Street, Cleveland, Ohio

B. Hammond, James J., and others. Woodoworking Technology, McKnight and McKnight Publishing Company, Bloomington, Illinois

C. McDonnell, Leo P., and others. Hand Woodworking Tools, Delmar Publishers, Inc., Albany, New York

D. Stanley Tools Catalog, Stanley Tools Division of the Stanley Works, New Britain, Connecticut

III. Agricultural Mechanics

F. Agricultural Construction and Maintenance

UNIT: 1. Water Supply

PROBLEM AREA: i. Illinois Water Well Pump Installation Code

TEACHING PLAN

I. INTRODUCTION: Water is essential for life. Uncontaminated drinking water is essential for health. Many water systems in Illinois depend upon wells. A knowledge of Illinois Department of Public Health rules and regulations for such installations is important.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from the Illinois Water Well Pump Installation Code.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[6]

A. Scope
   1. Code prescribes minimum standards for installation of water well pumps or equipment employed in withdrawing or obtaining water from a well for any use
      (a) Includes such seals and safeguards as may be necessary to protect from contamination
   2. Code does not apply to installation of pumps or equipment on water wells which are subject to regulation under other laws of the State unless these code rules and regulations have been adopted under those laws
   3. Installation of a pump or equipment on a well drilled or used for observation or any other purpose in connection with the development or operation of a gas storage project is also excluded from the provisions of this Code

[6] Most of outline from information found in publication listed under student reference section.

B. Definitions

1. Department -- Illinois Department of Public Health
2. Water well -- any excavation that is drilled, cored, bored, washed, driven, dug, jetted, or otherwise constructed when the intended use of such excavation is for acquisition of ground water
3. Pump installation -- the procedure employed in the placement and preparation for operation of equipment and materials utilized in withdrawing or obtaining water from a well
   (a) Includes all construction involved in making entrance into the well and establishing such seals and safeguards as may be necessary to protect such water from contamination
4. Water well pumps and equipment -- any equipment or materials utilized or intended for use in withdrawing or obtaining water from a well including pumps, seals, pressure tanks, fittings and controls
5. Well seal -- an arrangement or device used to cap a well or to establish a watertight closure of the junction of a well pump or piping with the well casing at the upper terminal of the well
6. Casing -- the pipe installed in a drilled hole to give unobstructed access to a water-bearing formation and includes the riser pipe of a buried slab type dug or bored well
7. Pipe sleeve -- a pipe cast in the cover slab of a dug or bored well to provide an entrance for pump components or use for venting, disinfection, or water level determination
8. Well vent -- an opening at the upper terminal of a well to provide for equalization of air pressure in the well or the release of gases
9. Contamination -- a change of the biological, chemical, or physical quality of a water so that it is actually or potentially harmful or injurious to the health of the user
10. Pitless well adapter -- an assembly of parts which will permit water to pass through the wall of the well casing or extension thereof
    (a) Provides access to the well and to the parts of the water system within the well
    (b) Provides for the transportation of the water and the protection of the well and water therein, from surface or near surface contamination
    (c) Parts or appurtenances to a pitless well adapter include, but are not limited to, the vent, the device(s) on or in the wall of the casing, and the cap or cover on the top of the casing or casing extension
11. Approved basement -- a room below ground surface, under a building and having an adequate drain not subject to backflow of liquid waste

C. General requirements
   1. Installation contractor
      (a) Installation of pumps or equipment shall be made only by or under supervision of persons, firms or corporations holding a valid license under the Illinois Water Well and Pump Installation Contractor's License Act unless exempt from provisions of that Act
   2. Notification of proposed installation
      (a) Prior to installation of a water well pump or equipment, the contractor shall notify the Department that the installation is to be made
         (1) Notification shall be given on such forms as are prescribed by the Department
   3. Completion report
      (a) Within 30 days after a water well pump or equipment has been installed, the contractor shall submit a report of the installation on such forms as are prescribed and furnished by the Department

D. Pump installation
   1. Upper well terminal
      (a) Well casing, curbs, and pitless well adapters shall terminate not less than 8 inches above the finished ground surface or pump house floor and at least 24 inches above maximum high water level as given by the most recent U.S. Geological Survey flood plain elevation map where flooding occurs
         (1) No casing shall be cut off or cut into below ground level except to install a pitless well adapter
   2. Pitless well adapter
      (a) Shall be so designed and constructed that the point or points of field attachment of the pitless well adapter to the well casing and all water contact surfaces on parts in contact with the ground shall be under pressure of the water system
      (b) The cap, casing cover or sanitary seal shall be self-draining and overlap the top of the casing or casing extension with a downward flange
      (c) There shall be no openings in the cover, within the outside diameter of the casing or casing extension, except for a factory installed vent
         (1) Such factory installed vent shall be installed in the cap or cover using a threaded or welded connection

(2) Vent opening shall be turned down, secured in position, reasonably tamper proof and be screened with not less than 16 mesh, non-corrodible screen or filtered in such a manner as to prevent the entry of insects

(d) The cover shall be watertight

(e) Pitless well adapters will require the approval of the Illinois Department of Public Health

3. Hand pumps

(a) Shall be of the force type equipped with a packing gland around the pump rod, a delivery spout which is closed and downward directed, and a one-piece bell type base which is part of the pump stand or is attached to the pump column in a watertight manner

(b) Installation

(1) Bell base of the pump shall be bolted with a gasket to a flange which is securely attached to the casing or pipe sleeve

4. Power driven pumps

(a) Design and operating principles of each type of power driven pump determines where each may be located with respect to a well

(b) The location selected for the pump determines what factors must be considered to make an acceptable installation

5. Location above well

(a) Shall be so mounted on the well casing, pipe sleeve, pump foundation or pump stand that a watertight closure is or can be made for the open end of the casing or sleeve

(1) The pump base bolted with a neoprene or rubber gasket or equivalent watertight seal to a foundation or plate provides an acceptable seal

(b) On large pump installations the bolting may be omitted when the weight of pump and column is sufficient to make a watertight contact with the gasket

(c) If the pump unit is not located over the casing or pipe sleeve, but the pump delivery or suction pipes emerge from the top of the well, a watertight expanding rubber seal or equivalent shall be installed between the well casing and piping to provide a watertight closure

(1) The top of the seal shall not extend below the uppermost edge of the casing or pipe sleeve

6. Location in well
   (a) Permissible for submersible pumps only
   (b) When the discharge line leaves the well at the top of the casing, the opening between the discharge line and casing or pipe sleeve shall be sealed watertight with an expanding rubber seal or equivalent device
   (c) When an underground discharge is desired, a pitless well adapter shall be installed
   (d) A check valve shall not be permitted between the well and the inlet side of the pressure tank
7. Offset from well
   (a) May be located in an approved basement provided the pump and all suction pipes are elevated at least 12 inches above the floor
   (b) All portions of suction lines buried below the ground surface between the well and the pump shall be enclosed in a pressure discharge line maintained at system pressure
8. Vents
   (a) All vent piping shall be of adequate size to allow equalization of air pressure in the well and shall be not less than one-half inch in diameter
   (b) Locate in such a manner as to prevent contamination of the well
   (c) Vent opening shall terminate at least 8 inches above the finished grade
      (1) Shall be turned down, secured in position, reasonably tamper proof, and be screened with not less than a 16 mesh screen or filtered in such a manner as to prevent the entry of insects
   (d) Particular attention shall be given to proper venting of wells in areas where toxic or inflammable gases are known to be a characteristic of the water
      (1) If determined that either of these types of gases are present, all vents when located in buildings shall be extended to discharge outside the building at a height where they will not be a hazard
9. Pump bearing lubrication
   (a) Shall be with water or oil which will not adversely affect the quality of the water to be pumped
10. Water level measurement
   (a) Piping for this purpose shall terminate above the upper well terminal, be capped watertight, and all openings around the piping at the point of entry into the well sealed watertight

(1) Provision for measuring water level in the well is desirable on wells of large capacity

E. Disinfection and samples
1. General
(a) When water is required to meet bacterial quality standards for human consumption, the well, pump, piping and pressure tank shall be disinfected by the contractor
(1) Sufficient chlorine shall be introduced to give a dosage of 100 parts per million to the water in the well
2. Disinfection
(a) Have a clean well before using chlorine disinfection
(1) Remove oil, grease, dirt, and other foreign matter from the well and pump, piping and other equipment before installation and the introduction of chlorine
3. Analysis
(a) If collection of a water sample is not part of the installation contract, the contractor shall instruct the owner on procedure for collection and submission of a water sample to an approved laboratory
4. Caution
(a) Work with chlorine in a well ventilated place
(b) Granules or strong liquid should not come in contact with skin or clothing
(c) Solutions are best handled in wood or crockery containers
(1) Metals are corroded by strong chlorine solutions

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have person from Illinois Department of Public Health speak to the class and answer questions about water well pump installation

B. Have water well pump installation contractor speak to the class and answer questions

C. Visit the site of a water well pump at various stages of installation

D. Collect a water sample from a well, and send it to an approved laboratory for analysis.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Examples of parts of pumps and equipment mentioned in teaching plan

B. Overhead transparencies of pumps and equipment and components mentioned in teaching plan

C. Materials for taking a water sample from a well and submitting it to an approved laboratory for analysis

VI. STUDENT REFERENCE:

A. Illinois Water Well Pump Installation Code (Rules and Regulations), State of Illinois Department of Public Health

VII. TEACHER REFERENCE:

A. Private Water Systems, Midwest Plan Service

III. Agricultural Mechanics

F. Agricultural Construction and Maintenance

UNIT: 1. Water Supply

PROBLEM AREA: b. Drilled Wells

TEACHING PLAN

I. INTRODUCTION: Drilled wells are important sources of water in Illinois. A safe water supply is dependent on a knowledge of sanitary engineering principles and approved procedures.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from Circular 4.052 Drilled Wells, Illinois Department of Public Health

III. OUTLINE OF INSTRUCTIONAL CONTENT:[7]

A. Location and construction
   1. General
      (a) Wells providing drinking water should be constructed and located in such a manner they will yield safe water at all times, and under all conditions
      (b) Contamination of a water supply normally occurs when seepage from privy vaults, sewers, septic tanks or other sewage systems, or surface contamination enters the well
      (c) Surface contamination
         (1) Carried by rain or surface water into the well through the top
         (2) May seep through the walls
      (d) Well must be constructed in such a manner that the top and first 10 feet are water-tight

[7] Most of outline from information found in publication listed in student reference section.

(1) In normal soil, contamination usually is eliminated after filtering down 10 feet

(e) Well platform should be placed on an earth fill at least one foot higher than the natural ground surface

(f) All sources of contamination should be located at a lower level than the well

(g) Surface drainage should be such as to prevent the formation of puddles or other accumulation of surface within a 15-foot radius of the well

2. Location

(a) No closer than 50 feet from a privy, tile sewer, drain line or septic tank

(b) No closer than 75 feet from a cesspool, seepage pit or subsurface seepage tile

3. Construction

(a) Top of well should be made absolutely watertight

(b) Upper 10 feet of the well lining should be constructed of 6-inch reinforced concrete or seamless well casing of steel, wrought or cast iron

(c) If a well vent is desired, it should be extended 18 inches about the platform or ground surface and be equipped with a turned down elbow

(1) Should have the opening screened with 24-mesh copper or other non-corrosive screen

(a) Two layers of 16-mesh house screen may be used as a substitute

4. Pump suction lines

(a) If the pump is located away from the well, the buried pipe leading to the pump from the well should be located at least as far away from sources of contamination as the well should be

5. Construction notes

(a) Insulated pump house should be as small as possible to contain equipment

(1) About 3 feet x 3 feet x 3 feet should be adequate for most installations

(b) If electric line is brought in through the floor and fixtures are attached to pressure tank instead of well then the entire building may be removed to service well and equipment

(1) Hinge may be placed at base of one wall

(c) The casing shall end at 6 inches above the floor and be equipped with a sanitary well seal

(d) The inside walls and roof should be faced with a vapor seal

B. New Drilled wells
1. Frost pits shall not be used on new drilled wells
   (a) The well casing shall terminate above ground level
   (b) Frost protection shall be provided by using an insulated pump house or by using a commercial pitless discharge unit
2. Jet, reciprocating, deep well turbine, direct suction, and submersible power pumps are all approved providing all suction, pressure, vent, and electric lines enter the casing through a watertight seal
3. Hand pumps are approved providing they are of the "force" type with a packing gland around the pump rod, are equipped with an enclosed, turned down spout, and have a bell type, one-piece base that is made as a part of the pump casing or is attached to the pump in a watertight manner
4. Pumps and pressure tanks may be located in the basement of a dwelling providing such basement is provided with adequate drainage
   (a) All wells must be located outside of basement walls as far from sewers as possible but no closer than the minimum distances previously listed

C. Rehabilitating existing pits
1. Well casing must terminate at least 6 inches above pit floor and be sealed with a sanitary well seal
2. A concrete floor shall be provided
3. Walls shall be of watertight masonry construction
4. Pit top or platform shall be of concrete and all openings to the pit shall be of watertight construction
5. Pit shall be equipped with either a separate drain discharging to the surface of the ground above flooding or a concrete sump and pump discharging with free-fall to the ground surface
   (a) Under no circumstances should a pit drain be connected to any other tile or drain line
6. Any pit or well vent shall be carried to a point at least 18 inches above the ground surface
   (a) All vents shall be equipped with a "turned-down" elbow and the opening shall be screened with 2 layers of non-corrosive fly screen

D. Drilled well disinfection
1. A new well, or one which has been cleaned or repaired, normally contains contamination which may remain for weeks unless the well is thoroughly disinfected
2. This may be accomplished by the use of ordinary laundry bleach solution
3. Directions for disinfecting a drilled well with 100 PPM (parts per million) chlorine

Dia. well in inches	Gallons per ft.	Amount of laundry bleach (5.25% chlorine) required for each 100 gallons of water equals 3 cups. One cup equals an 8 ounce measuring cup, 2 cups equal 1 pint and 4 cups equal 1 quart.
3	.37	
4	.65	
5	1.00	
6	1.50	
8	2.60	
10	4.10	
12	6.00	

4. Steps
   (a) Determine the amount of water in the well by multiplying the gallons per feet by the number of feet of water in the well
      (1) Considering the well full of water will be satisfactory in most cases, as a slight overdose does no harm
   (b) For each 100 gallons of water in the well, use the amount of bleach given in the table above
      (1) Mix this total amount in about 10 gallons of water
   (c) Pour this solution into the top of the well between the casing and the drop pipe before the well seal is installed
      (1) This may involve a permanent raising of the pump about 4 inches in order to allow sufficient space for the addition of the solution and for the placement of a sanitary well seal
   (d) Connect one or more hoses from faucets on the discharge side of the pressure tank to the top of the well for at least 15 minutes
      (1) Then open each faucet in the system until a chlorine smell or taste appears
      (2) Close all faucets
      (3) Seal the top of the casing with a sanitary well seal
   (e) Let stand for several hours, preferably overnight
   (f) After standing, operate the pump, discharging from all outlets until all chlorine odor and taste disappears

(g) After several days use, submit a sample of the water to Illinois Department of Public Health, Division of Sanitary Engineering laboratory for analysis
(1) See County Health Department person for details

5. Chlorine hazards to avoid
(a) When working with chlorine, always be in an open or well ventilated place
(b) Do not allow the strong liquid to remain in contact with the skin or clothing
(c) Solutions are best handled in wood or crockery containers
(1) Metal containers are corroded by strong chlorine solutions

E. Limestone
1. Wells obtaining water from limestone should always be regarded with caution
2. In subdivisions, or other densely populated areas, there should be at least 50 feet of soil over the limestone in order to obtain a reasonably safe water supply
3. In sparsely populated rural areas, a depth of 30 feet of soil over the limestone normally is satisfactory
4. If there are any rock outcrops, quarries or abandoned wells within a quarter of a mile, or if the depth of soil over the rock is less than specified, all water pumped from the well should be adequately and continuously chlorinated

F. Analyses and samples
1. Bacterial analyses of samples of drinking water are made, free of charge, for rural sources upon request to the Illinois Department of Public Health, or County Health Department
(a) A special container for bacteriological a analysis, with instructions, is available upon request

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have person from County Health Department talk to class and answer questions.

B. Have contractor for drilled wells talk to class and answer questions.

C. Visit the site of a drilled well at various stages of construction.

D. Collect a water sample from a drilled well and send it to an approved laboratory for analysis.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Examples of parts and equipment mentioned in this teaching plan

B. Special containers for bacteriological analysis, with instructions

C. Overhead transparencies of schematic drawing of insulated pump house, hand pump installation, and other illustrations--especially related to different kinds of pumps

VI. STUDENT REFERENCE:

A. Circular 4.052 Drilled Wells, Illinois Department of Public Health, Division of Sanitary Engineering

VII. TEACHER REFERENCE:

A. Private Water Systems, Midwest Plan Service

III. Agricultural Mechanics

G. Agricultural Electrification

UNIT: 2. Planning for Electrical Wiring

PROBLEM AREA: i. Local Electrical Code--Electrical Inspector and His Work

TEACHING PLAN

I. INTRODUCTION: The local electrical code is important for the safety of all users of electricity in a particular locality. The electrical inspector is the single, most influential person in seeing that the provisions of the local electrical code are carried out for the benefit of the citizens.

II. STUDENT PERFORMANCE OBJECTIVES:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from this teaching plan and the references listed.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[8]

A. Establishment of office of electrical inspector
   1. Shall be appointed by the city manager
   2. He shall receive such compensation as may be provided by ordinance
   3. He shall be under the supervision of the commissioner of buildings

B. Bond - Oath
   1. Before entering upon the duties of his office
      (a) He shall take oath prescribed for all town officers
      (b) He shall execute and deliver a bond payable to the town in the penal sum of $2,000 with sureties to be approved by the town clerk, conditioned upon the faithful performance of the duties of his office

C. Qualifications
   1. No person shall be appointed to the office of electrical inspector who is not reasonably skilled

[8] Most of outline from information found in Town of Normal Electrical Code.

in the various departments of electricity and well versed in the rules and requirements of the National Electrical Code

D. Duties of the electrical inspector
   1. Shall enforce all laws relating to the installation, alteration and use of electrical equipment
   2. See that the construction, maintenance and control of all electrical appliances and apparatus and systems of electrical wiring and systems of poles for the carriage of said electrical wires and the electrical wiring of all buildings in the town, either public or private, shall conform and comply with the rules and regulations established
      (a) Also electric or illuminated signs or billboards
   3. Electrical inspector, in the discharge of his official duties, and upon proper identification, shall have authority to enter any building, structure or premise at any reasonable hour
   4. In dangerous situations, the electrical inspector shall have the authority to order service discontinued to any property until such conditions are corrected

E. Maintenance of office-duty of inspection
   1. Electrical inspector shall establish and maintain an office at the city hall
   2. Has duty to inspect all uses of electricity
      (a) Within the corporate limits of the town or on town owned property outside the corporate limits of the town
      (b) Whether used either as a motive power or for heating
      (c) Whether used for lighting or for telegraph or telephone purposes
         (1) Or for any other purpose whatever requiring a connected system of wires or of poles and wires
            (a) Extending throughout, along or across the streets, alleys or other public places of the town or any portion thereof
            --Or where electricity is used in any private property within the town when connected with any such general system of electrical power or any isolated system

F. Inspection and tests
   1. The electrical inspector shall, within one working day of notification of completion by the contractor, make his inspection

2. No work in connection with an electrical wiring system shall be covered or concealed until it has been inspected and permission to do so has been granted by the electrical inspector
3. Concealment can take place only after the electrical inspector has posted a notice giving permission on the Building Permit Card
4. On completion of the work, the electrical inspector shall inspect the work and cause tests to be made of the operation of the entire system to insure compliance with all requirements
5. Any work which is rejected by the electrical inspector shall be corrected and reinspected within 30 days
   (a) If, upon reinspection, an electric wiring system is found to be defective and unsafe
      (1) The electrical inspector shall revoke all certificates and permits in effect
      (2) The use of such system shall be discontinued until it has been made to conform to required standards and after a new permit has been issued

G. Inspection upon complaint
1. Upon complaint in writing of any citizen of this town as to the unsafe condition of any part of any such electrical system within the town
   (a) It shall be the duty of the electrical inspector to inspect each part complained of
      (1) If he finds any defect, he is to require the person, firm or corporation at fault in the matter to put such part in proper condition

H. Condemnation of electrical work or equipment -- right of appeal
1. The town electrical inspector shall have the authority upon inspection or reinspection to condemn any or all electrical work installed or being installed that may be considered unsafe or hazardous to life or property
   (a) He shall serve a written notice upon the person owning, using or installing the same to place the work in a secure and safe condition
2. If any person owning, using or installing such condemned electrical work shall deem that he is aggrieved by the condemnation
   (a) He shall have the right to appeal from the decision of the electrical inspector to the Electrical Commission within 10 days after receiving the written condemnation notice
      (1) The Commission shall select a reasonable time and place for a hearing and give due notice to the parties involved

(a) And shall render a decision on the appeal without unreasonable delay

(2) The decision of the Electrical Commission shall be final

(a) Upon condemnation of any electrical work, the electrical inspector is authorized to refuse the connection or to order the disconnection of any electrical supply lines until the condemned work has been made safe and is approved by the electrical inspector

--The order shall be in writing, signed by the electrical inspector and served upon both utilities furnishing services in the town and upon the owner

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Have town electrical inspector talk to class and answer questions.

B. Take a field trip to see the town electrical inspector at work.

C. Attend a hearing of the Electrical Commission.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Sample forms used by the town electrical inspector

B. Overhead transparencies and overhead projector

VI. STUDENT REFERENCE:

A. Town electrical code

VII. TEACHER REFERENCES:

A. National Electrical Code, National Fire Protection Association

B. Richter, H. P. Practical Electrical Wiring

III. Agricultural Mechanics

G. Agricultural Electrification

UNIT: 5. Residential and Farm Electric Motors

PROBLEM AREA: c. Nameplate Information

TEACHING PLAN

I. INTRODUCTION: The nameplate of a motor contains a lot of information which is useful to the owner who can properly interpret it. It will help a person avoid errors which can waste time and cost money.

II. STUDENT PERFORMANCE OBJECTIVE:

The student will be able to:

A. Pass an examination with 90 percent accuracy on the basis of approved answers obtained from references listed at the end of this teaching plan.

III. OUTLINE OF INSTRUCTIONAL CONTENT:[9]

A. Information which might appear on a motor nameplate:
   1. Manufacturer's name
   2. Model: M13265
   3. Type: CSH
   4. Frame: 482
   5. Code: L
   6. Volts: 115 - 230
   7. Cyc: 60
   8. Ph: 1
   9. Amps: 16 - 8
   10. Hp: 1
   11. RPM: 1725
   12. SF: 1.15
   13. Thermal protector
   14. AC motor

B. Manufacturer's name, model number, type number, frame number, and code number
   1. Information needed when ordering a replacement motor

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[9]Most of outline from information found in Anderson, Paul M., Electrical Tips for Everyone.

(a) Name and numbers identify the motor for the supplier and manufacturer

C. Voltage
1. Voltage at which the motor should be used
2. If two voltages (115/230) are listed, the motor can be used on either 115 volts or 230 volts
3. A wiring change is necessary inside the motor to change from 115 volts to 230 volts and vice versa
4. A one percent drop in voltage will reduce the turning effort of a motor about two percent
   (a) Low voltage at the motor means an overloaded motor
      (1) Result is high operating temperatures or inability to start required loads
         (a) Either will cause motor "burn-outs"
5. Never should the voltage at the motor be less than 90 percent of that stated on the nameplate
6. Motors designed for 110 and 120 volts both will operate on 115 volts
   (a) One designed for 110 volts will operate better
   (b) Voltage loss in the line will reduce the 115 volts at the source so there will be about 110 volts at the motor

D. Cycles (Cyc)
1. 60 cycles per second is standard frequency for household current
2. A motor will work well as long as the number of cycles is within 10 percent of the value stamped on the nameplate
   (a) Within this limit there will be a small variation in motor speed
3. For normal applications, any motor bought should be stamped for 60 cycles
4. Instead of "cycle" the abbreviations "c/s" or "cps" may be used -- meaning cycles per second
   (a) The trend is toward using the term "Hertz" or its abbreviation "Hz" in the place of "cycles per second"
      (1) The term "Hertz" is named after Prof. H. R. Hertz, German scientist who discovered the cyclical nature of electrical phenomena
      (2) 60-cycle current is referred to as 60 Hz

E. Phase (Ph)
1. The number "one" means a single phase motor
2. The number "three" means a three phase motor
   (a) Use three phase motor if power supply is three phase

3. Single phase motors can be used on a three phase system by "splitting" (using) one phase out of the three phase system
4. A three phase motor cannot be used on a single phase line without the use of a phase converter

F. Horsepower (Hp)
1. Value given in this space on the nameplate is the rated shaft output of the motor
2. One horsepower is equal to 746 watts
3. To get one horsepower at the shaft, it is necessary to put more than 746 watts into the motor
   (a) The input to the motor is determined by multiplying nameplate amps times volts
      (1) In the case of one horsepower, according to nameplate information, the actual figures could be 8 amps times 230 volts or 1840 watts
         (a) The large difference between the 1840 watt input and the 746 watts output at the shaft can be accounted for by motor efficiency and power factor
            --Motor efficiency commonly ranges from 70 to 80 percent
            --Power factor is the result of certain characterisitics of alternating current and is <u>not</u> usable by the motor
   (b) To select wire size for a motor circuit, use the amperage stated on the nameplate even though a part of this amperage produces power which cannot be used by the motor

G. Revolutions per minute (RPM)
1. This is the speed at which the motor will rotate when developing its rated horsepower
2. If overloaded, the motor will run slower than the RPM stamped on its nameplate
   (a) If the overload is increased too far, the motor will stall
      (1) It will burn out if not quickly removed from the line
3. Low voltage reduces the speed of the motor
4. When running at no load the speed may be 25 to 50 RPM higher

H. Service factor (SF)
1. Motors used to be rated on the basis of a temperature rise, over and above the temperature at the motor location
   (a) Ordinary motors were based on a rise of not over 40 degrees C (centigrade)

(1) Motor could be used continuously at its rated horsepower without harm if its temperature did not increase more than 40 degrees C
(a) C (centigrade) now sometimes is known as Celsius scale after Anders Celsius, Swedish scientist who invented it

(b) Motors are no longer rated on a temperature rise basis
(1) Heat-resisting qualities of the wire used to wind motors, and the insulating materials in motors, have been improved to the extent it's no longer necessary to rate them on a temperature rise basis
(a) Motors now can run at much higher temperatures without damage

2. Service factor can range from 1.00 to 1.35
(a) If service factor is 1.00, motor can be operated in a location where the ambient temperature is not over 40 degrees C at its rated horsepower continuously without damage to the motor
(b) If service factor is 1.15, it can be used at up to 1.15 times its rated horsepower under same conditions as listed for (a) above
(c) Should be considered as a margin of safety which manufacturer has built into the motor, rather than determining the size of motor to use in an application requiring 1.15 times motor's rated horsepower
(1) Margin of safety then becomes a reserve for unforseen loading such as tight belts, misalignment, tight bearings, or momentary overloads
(2) A service factor of 1.00 provides no such margin of safety

I. Thermal protector
1. A device for protecting a motor against overloads
2. Location is indicated by a small red button
(a) Usually at one end of the motor
3. Is reusable by pushing the button to reset it after allowing a short cooling off period

J. AC motor
1. Use only on alternating current
2. DC motors can be used only on direct current
3. A few motors are marked AC or DC
(a) They can be used on either AC or DC current

IV. POSSIBLE STUDENT LEARNING ACTIVITIES:

A. Practice interpreting nameplate data for motors used in agricultural mechanics shop and at home.

B. Have a motor supplier or manufacturer's representative speak to the class and answer questions.

V. SPECIAL MATERIALS AND EQUIPMENT:

A. Electric motors with nameplates on them

B. Nameplate data copied from nameplates on electric motors

C. Overhead transparencies and overhead projector

VI. STUDENT REFERENCE:

A. V.A.S. Electric Motors for Farm Use

VII. TEACHER REFERENCES:

A. Anderson, Paul M. Electrical Tips for Everyone, Correspondence Course in Agriculture and Home Economics, The Pennsylvania State University, College of Agriculture, Extension Service, University Park, Pennsylvania

B. Richter, H. P. Practical Electrical Wiring, McGraw-Hill Book Company

REFERENCES

Specific References

III. Agricultural Mechanics

A. Agricultural Power and Machinery Cluster Area

1. Hunt, Donnell. Farm Power and Machinery Management, Iowa State University Press, Ames, Iowa.

2. Implement and Tractor Red Book, Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri.

3. Agricultural Engineers Yearbook, American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, Michigan.

4. Hunt, Donnell. "Selection of Self-Propelled Combines" reprint from Illinois Research, University of Illinois Experiment Station, Volume 15, Number 4, Fall 1973.

5. The Planter -- Selection, Adjustment, Maintenance, and Use, V.A.S. 3021. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

6. Tractor Operation and Daily Care, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

7. Safe Tractor and Farm Machinery Operation by Center for Rural Manpower and Public Affairs, Michigan State University. Available from Illinois Curriculum Management Center, State of Illinois, Division of Vocational and Technical Education, Springfield, Illinois.

8. Operating Tractors for Grounds Keeping and Ornamental Horticulture, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

9. Handling and Using Gasoline and Liquid Petroleum Gas, V.A.S. 3013. Voactional Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

10. Selecting and Storing Fuels and Lubricants, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

11. Small Engines -- Principles of Operation, Trouble Shooting and Tune-Up, V.A.S. 3014. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

12. Care and Operation of Small Engines, Volume I, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

13. Tractor Maintenance Principles and Procedures, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

14. Fundamentals of Service -- Engines, John Deere Service Publications, John Deere Road, Moline, Illinois.

15. Fundamentals of Service -- Power Trains, John Deere Service Publications, John Deere Road, Moline, Illinois.

16. Tires for Farm Equipment, V.A.S. 3031. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

17. Fundamentals of Service -- Hydraulics, John Deer Service Publications, John Deere Road, Moline, Illinois.

18. The Two-Cycle Engine, V.A.S. 3020. Vocational Agricultural Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

19. Fundamentals of Machine Operation -- Preventive Maintenance, John Deere Service Publications, John Deere Road, Moline, Illinois.

20. Phipps, Lloyd J. Mechanics in Agriculture. The Interstate Printers and Publishers, Danville, Illinois.

21. Stone, Archie A. and Gulvin, Harold E. Machines for Power Farming. John Wiley and Sons, Inc., One Wiley Drive, Somerset, New Jersey.

22. Fundamentals of Machine Operation -- Combine Harvesting. John Deere Service Publications, John Deere Road, Moline, Illinois.

23. Spray Painting, V.A.S. 2015. Voactional Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

24. Engine Compression and Cylinder Leakage Testing, V.A.S. 3025. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

25. The Engine Cooling System, V.A.S. 3030. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

26. The Storage Battery, V.A.S. 3024. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois

27. The Spark Plug -- Operation, Selection and Maintenance, V.A.S. 3026. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

28. The Ignition System -- Testing and Analyzing Test Results, V.A.S. 3028. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

29. Fundamentals of Service -- Electrical Systems, John Deere Service Publications, John Deere Road, Moline, Illinois.

30. Small Engines Service Manual, Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri.

31. Micrometers and Related Measuring Tools, V.A.S. 3023. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

32. Farm Tractor Tune-Up and Service Specifications, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

33. Farm Tractor Tune-Up, V.A.S. 3008. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

34. Small Engines -- Repair and Overhaul, V.A.S. 3019. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

35. Maintenance and Repair of Small Engines, Volume II. American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

36. ABC's of Hand Tools, General Motors Corporation, Public Relations Staff, Room 1-101, General Motors Building, Detroit, Michigan.

37. Equipment and Supplies Catalog, Brodhead Garrett Company, 4560 East 71st Street, Cleveland, Ohio.

38. Fundamentals of Service -- Shop Tools, John Deer Service Publications, John Deere Road, Moline, Illinois.

39. Air Compressors, V.A.S. 3018. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

40. Safety in the Agricultural Mechanics Shop, V.A.S. 3022. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

41. Tool Identification Kit, The Interstate Printers and Publishers, 19-27 North Jackson Street, Danville, Illinois.

42. Machine Shop and Technology Tool Identification Kit, The Interstate Printers and Publishers, 19-27 North Jackson Street, Danville, Illinois.

43. Collazzo, Charles G. Building Good Customer Relations, Small Marketers Aid, Small Business Administration Field Office, Federal Office Building, 219 South Dearborn Street, Chicago, Illinois.

44. Entenberg, Robert D. Are You Selling Enough Service? Small Marketers Aid, Small Business Administration Field Office, Federal Office Building, 219 South Dearborn Street, Chicago, Illinois.

45. Everett, Ralph. A Fistful of Future in 4 Easy Steps, Empire Sales Training Center, Inc., 443 N.E. 103 Street, Miami, Florida.

46. Ernest, John W. and DaVall, George M. Salesmanship Fundamentals, McGraw-Hill Books, Manchester Road, Manchester, Missouri.

47. Vreeland, Richard C. Customers, A Neglected Sales Force, Small Marketers Aid, Small Business Administration Field Office, Federal Office Building, 219 South Dearborn Street, Chicago, Illinois.

48. Otterbourg, Robert K. Building Customer Confidence in Your Service Shop, Small Marketers Aid, Small Business Administration Field Office, Federal Office Building, 219 South Dearborn Street, Chicago, Illinois.

B. Agricultural Structures and Conveniences Cluster Area

49. Farmstead Planning Handbook, Midwest Plan Service. Available from Cooperative Extension Service, Department of Agricultural Engineering, College of Agriculture, University of Illinois, Urbana, Illinois.

50. Structures and Environment Handbook, Midwest Plan Service, Department of Agricultural Engineering, College of Agriculture, University of Illinois, Urbana, Illinois.

51. Building with Concrete Masonry, V.A.S. 3034. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

52. Making and Using Concrete on the Farm, V.A.S. 3007. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

53. Applying Asphalt Roofing and Siding Products, V.A.S. 3035. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

54. Exterior Plywood in Farm Construction, American Plywood Association, 1119 A Street, Tacoma, Washington.

55. Jones, Mack M. Shopwork on the Farm, McGraw-Hill Book Company, Manchester Road, Manchester, Missouri.

56. Wakeman, T. J. and McCoy, Vernon L. The Farm Shop, The Macmillan Company, School Division, 866 Third Avenue, New York, N.Y.

57. Use of the Square in Farm Construction, V.A.S. 3009. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

58. Manly, H. P. Plumbing Installation and Repair, Frederick J. Drake and Company Publishers, 7312 North Ridgeway Avenue, Skokie, Illinois.

C.&D. Soil and Water Management for Agricultural Lands and Public Recreational Areas

59. Snowmobile Service Manual, Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri.

60. Chain Saw Service Manual, Intertec Publishing Corporation, 1014 Wyandotte Street, Kansas City, Missouri.

61. Farm Surveying, V.A.S. 3010. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

62. Legal Descriptions of Illinois Real Estate, C800. Agricultural Publications Office, 123 Mumford Hall, Urbana, Illinois.

63. Terracing, V.A.S. 4038. Vocational Agricultural Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

64. Grass Waterways, V.A.S. 4021. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

65. Drainage of Agricultural Land, Water Information Center, Inc., 44 Sintsink Drive, East Port Washington, New York.

66. Illinois Farm Drainage Law, C751. Agricultural Publications Office, 123 Mumford Hall, Urbana, Illinois.

67 Ponds for Water Supply and Recreation, Agriculture Handbook No. 387. Soil Conservation Service, U.S. Department of Agriculture. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

68. Illinois Engineering Practice Standards and Specifications for Conservation Practices, Soil Conservation Service, U.S. Department of Agriculture, Post Office Box 678, Champaign, Illinois.

E. Agricultural Mechanics Skills

69. Shop Planning -- Basic Design of Shop and Service Centers, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

70. Shielded Metal-Arc Welding, V.A.S. 3004a. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

71. Oxyacetylene Welding and Cutting, V.A.S. 3001a. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

72. Metallic Inert Gas (MIG) Welding, V.A.S. 3037. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

73. Tungsten Inert Gas (TIG) Welding, V.A.S. 3036. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

74. Soldering for Home, Farm, and Shop Applications, V.A.S. 3027. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

75. Farm Metal Work, V.A.S. 3002. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

76. Sharpening Hand Tools, V.A.S. 3005. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

77. McDonnell, Leo P., Kidd, Donald M., and Siy, Louis J. Hand Woodworking Tools, Delmar Publishers, Inc., Mountainview Avenue, Albany, New York.

78. Hammond, James J., Donnelly, Edward T., Harrod, Walter F., and Rayner, Norman A. Woodworking Technology, McKnight and McKnight Publishing Company, Bloomington, Illinois.

79. Stanley Tools Catalog, Stanley Tools Division of Stanley Works, New Britain, Connecticut.

80. McDonnell, Leo P., Kidd, Donald M., and Siy, Louis J. Portable Power Tools, Delmar Publishers, Inc., Mountainview Avenue, Albany, New York.

F. Agricultural Construction and Maintenance

81. Private Water Systems, Midwest Plan Service. Available from Cooperative Extension Service, Department of Agricultural Engineering, College of Agriculture, University of Illinois, Urbana, Illinois.

82. Planning an Individual Water System, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

83. Illinois Water Pump Installation Code, State of Illinois Department of Public Health, Consumer Health Protection, Springfield, Illinois.

84. Drilled Wells, Circular 4.052. Illinois Department of Public Health, Division of Sanitary Engineering, Springfield, Illinois.

85. Dug Wells, Circular 4.051. Illinois Department of Public Health, Division of General Sanitation, Springfield, Illinois.

86. Soils and Septic Tanks, Agriculture Information Bulletin. Soil Conservation Service, U.S. Department of Agriculture. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

87. Planning Grain-Feed Handling, Midwest Plan Service. Available from Cooperative Extension Service, Department of Agricultural Engineering, College of Agriculture, University of Illinois, Urbana, Illinois.

G. Agricultural Electrification

88. Electrical Hazards on the Farm, V.A.S. 3012. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

89. Anderson, Paul M. Electrical Tips for Everyone, Correspondence Courses in Agriculture and Home Economics, The Pennsylvania State University, College of Agriculture, Extension Service, University Park, Pennsylvania.

90. National Electrical Code, National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts. Available from Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

91. Lightning and Lightning Protection on the Farm, V.A.S. 3011. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

92. Planning for Electrical Wiring, V.A.S. 3003b. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

93. Using Three-Phase Electrical Power on the Farm, V.A.S. 3038. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

94. Electrical Wiring Procedures, V.A.S. 3016a. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

95. Richter, H. P. Wiring Simplified. Park Publishing, Inc., P. O. Box 8527 (Lake Street Station), Minneapolis, Minnesota.

96. Richter, H. P. Practical Electrical Wiring. McGraw-Hill Book Company, Manchester Road, Manchester, Missouri.

97. Applying Electrical Controls in Farm Production, V.A.S. Vocational Agricultural Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

98. Electric Motors for Farm Use. Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

Selected References for More Information

A. Agricultural Machinery Teaching Materials from John Deere, John Deere Service Publications, John Deere Road, Moline, Illinois.

Fundamentals of Machine Operation series and Fundamentals of Service series of books, slide sets, and other aids.

B. Aids to Educators, Educational Relations, Public Relations Staff, General Motors Building, Detroit, Michigan.

Examples of aids listed are: ABC's of Hand Tools, A Power Primer, and Diesel - The Modern Power. Many of the items listed are available in limited quantities at no cost to educators for use in classrooms and shops. There are some materials for which a small charge is made.

C. Booklet listing teaching aids and prices, American Association of Vocational Instructional Materials, Engineering Center, Athens, Georgia.

Publications and visual aids in agricultural mechanics for use at the secondary level.

D. Booklet, "Delco-Remy Training Aids," with separate price list and order blank, Technical Literature Section, Delco-Remy Division of General Motors Corporation, Anderson, Indiana.

Booklet describes and illustrates teaching aids available from this source, information concerning GM Training Centers and Delco-Remy Service Schools, and how accredited schools can order equipment for classroom use.

E. Catalog and separate price list for Midwest Plan Service Plans, Extension Service, Department of Agricultural Engineering, College of Agriculture, University of Illinois, Urbana, Illinois.

Publications about such subjects as livestock waste management, trusses, handbooks, beef housing, swine housing, hay and silage storage, grain storage, machinery storage, and insulated pump house.

F. Careers in Farm Machinery Sales and Service filmstrip and script, Vocational Education Productions, California State Polytechnic College, San Luis Obispo, California.

Each frame of the filmstrip is pictured by the statement made about it in the script booklet. A booklet listing other aids (including publications) is available upon request.

G. Farm and Ranch Safety Guide, National Safety Council, 425 North Michigan Avenue, Chicago, Illinois.

State and Federal governments are taking a much more militant role in enforcing safety laws, rules, and regulations. This guide provides quite a lot of information which should be helpful in establishing a farm or ranch safety plan effective enough to keep the owner out of trouble with safety inspectors. Even more important, however, is the saving of life and property which will result.

A list of other publications from the National Safety Council is available upon request. The Farm Department, for example, publishes the Farm Safety Review six times a year. Tractor safety and precautions to be taken around overhead power lines illustrate topics covered in the publication.

H. Hobar Publications Catalog, Hobar Publications, Division of Hobar Enterprises, Inc., 1305 Tiller Lane, St. Paul, Minnesota.

Manuals, visuals, and other items designed for shop instructors and students in vocational agriculture, industrial education, trades and industrial education, and vocational-technical schools are included.

I. NASCO Agricultural Sciences Catalog, NASCO, Fort Atkinson, Wisconsin.

Among the many items listed in agricultural sciences are those of special interest to high school agricultural mechanics instructors.

J. Ohio Curriculum Materials Description and Price List, Ohio Agricultural Education, Curriculum Materials Service, Room 201, 2120 Fyffe Road, Columbus, Ohio.

Has a section on agricultural engineering. The section includes listings for publications, color slide sets, and overhead projection transparencies.

K. Skill Sheets for Agricultural Mechanics, Department of Agricultural Education, Iowa State University, Ames, Iowa. Available from Illinois Curriculum Management Center, State of Illinois, Division of Vocational and Technical Education, Springfield, Illinois.

Booklet developed especially for use in high school agricultural mechanics shops. Examples of jobs covered are: sharpening the twist drill bit, cleaning and servicing an electric motor, and tool sharpening guage. Two similar booklets from the same source are: Skill Sheets for Agricultural Machinery and Skill Sheets for Small Gasoline Engines.

L. Teaching Materials Catalog, Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

Lists subject matter units, slide films, overhead transparencies, and other aids for use in agriculture mechanics classes at the secondary, post-secondary and adult levels. Has other listings in addition to the agricultural mechanics areas. The materials from the Vocational Agriculture Service are useful, quite inexpensive, and up-do-date.

M. List of Available Publications of the United States Department of Agriculture, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Has many listings in agricultural engineering and related areas. Other useful information is provided.

N. List of U.S. Department of Health, Education, and Welfare Office of Education Publications, Office of Education, U.S. Department of Health, Education and Welfare, Washington, D.C.

Has listings of publications useful for high school instructors of agricultural mechanics. The U.S. Office of Education contracts with various agencies to produce such aids on a continuing basis. A recent example of this is the Career Preparation in Agricultural Equipment and Mechanics -- A Curriculum Guide for High School Vocational Agriculture. It is one of ten guides developed under the direction of the Ohio Career Education and Curriculum Management Laboratory in Agricultural Education, The Ohio State University, Columbus, Ohio.

SCHOOL FACILITIES, EQUIPMENT AND SUPPLIES

The following are necessary for conducting a successful program in agricultural mechanics:

A clean, comfortable classroom which is well lighted and properly equipped. It must be large enough for the largest class which will use it.

A shop with at least 200 square feet of area for each student in the largest shop section. It should have adequate lighting, ventilating and exhausting. There should be enough tools and equipment for the largest shop class, and they should be of good quality.

Enough inside and outside storage space. Many facilities are deficient in this regard.

Many hand tools, power tools, equipment, and supply (consumable) items are needed. Quantities will depend upon such things as how comprehensive the agricultural mechanics program is and how many students and adults are involved.

The partial list of tools used in small engine work which follows represents only one small area of agricultural mechanics, yet quite a large number of tools results:

- Box end wrenches
- 3/8" drive socket set
- Ignition tool kit
- Allen wrench set
- Pliers:
  - Needle nose
  - Diagonal cutting
  - Adjustable
  - Vise grip
- Screwdrivers:
  - Two standard sizes
  - Phillips head
  - Offset
  - Screw holding type
  - Magnetic
  - Clutch type
- Spark plug sockets
  - Three sizes
- Taps and dies
- Valve lifter
- Piston ring compressor
- Piston ring expander
- Micrometers
  - Inside
  - Outside
- Punches:
  - Center
  - Pin
  - 1/2 drift soft brass
- Hammers:
  - Ball peen
  - Lead
  - Plastic
- Files:
  - Point
  - Mill
  - Other
- Open end wrenches
- Adjustable wrenches
- Vises and vise fixtures
- Drills:
  - Hand
  - Drill press
- Drill bits
- Valve seat cutter
- Various pullers
- Adjustable reamers
- Cylinder dial guage
- Torque wrench
- Compression tester

Other items and their sources are listed as examples of things necessary for carrying out most programs recognized as successful:

	Item	Source
1.	Updated reference books	Publishing company
2.	Current agricultural magazines with agricultural mechanics articles	Publishing company
3.	Current agricultural mechanics magazines	Publishing company
4.	Current bulletins and circulars	Extension Service
5.	Agricultural Mechanics Releases	Vocational Agriculture Service
6.	Cumulative Record Books	Vocational Agriculture Service
7.	Tool charts	Stanley Tools Division of Stanley Works
8.	Slidefilms, overhead transparencies, color slide sets, and other aids	Vocational Agriculture Service American Association of Vocational Instructional Materials NASCO Hobar Publications Various other commercial companies
9.	Tool identification kits and Hardware Study and Identification Kit	Interstate Printers and Publishers Catalog
10.	Agricultural mechanics hand tools, power tools, equipment, consumable supplies and related items	Brodhead-Garrett Catalog Midwest Supply Service Catalog NASCO Catalog Patterson Brothers Catalog Sears and Roebuck Catalog Local community

Any agricultural mechanics program will be strengthened if the instructor is able to arrange for community resources to be utilized on a regular basis. Examples of individuals and businesses which might be willing to cooperate in a worthwhile educational effort are:

a. Agricultural Power and Machinery Dealership

b. Carpenter

c. Plumber

d. Conservationist

e. Local Electrical Inspector

f. Manufacturer's Representative

g. Hardware Store Owner

h. Lumber Company Manager

i. Electric Motor Repair Shop

j. Building Contractor

k. Painter

l. City Building Inspector

m. Drilled Well Contractor

n. Tile Drainage Contractor

o. Concrete Contractors

p. Steel Buildings Construction Business

AUDIO VISUAL SOURCES AND MATERIALS

Source: Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois.

III. Agricultural Mechanics

A. Agricultural Power and Machinery Cluster

Slidefilms

1 av. Calibrating Field Sprayers VAS 442
2 av. Calibrating a Granular Applicator VAS 443
3 av. Using Power Lawn Mowers Safely VAS 498

Transparencies

4 av. Tractor Safety
5 av. Tractor Tune-Up and Maintenance
6 av. Spray Painting

B. Agricultural Structures and Conveniences Cluster

Slidefilms

7 av. Selection and Application of Galvanized Roofing and Siding VAS 423
8 av. Using the Level to Stake Out a Building VAS 439
9 av. The Use of Welded Wire Fabric on the Farm VAS 432
10 av. Planning and Preparing for Concrete Masonry Construction VAS 433
11 av. Laying Concrete Masonry Units VAS 434
12 av Special Concrete Masonry Problems VAS 435
13 av. Identification of Pipe and Fittings VAS 480

Transparencies

14 av. Asphalt Roofing

C.&D. Soil and Water Management for Agricultural Lands and Public Recreational Areas Cluster

Slidefilms

15 av. Using the Steel Tape in Surveying VAS 436
16 av. Recording the Field Notes in Surveying VAS 437
17 av. Using the Level in Farm Surveying VAS 438

E. Agricultural Mechanics Skills Cluster

Slidefilms

18 av. Oxyacetylene - Assembling, Testing, Lighting Blowpipe VAS 454
19 av. Oxyacetylene - Cutting, Bronze Welding VAS 455
20 av. Oxyacetylene - Fusion Welding, Hard Surfacing, etc. VAS 456
21 av. Arc Welding - Process, Equipment, and Safety VAS 450-64
22 av. Arc Welding - Flat Position Welding VAS 451-64
23 av. Arc Welding - Vertical, Horizontal and Overhead Position Welding VAS 452-64
24 av. The Jointer - How To Use It Safely VAS 460
25 av. Drill Press - How To Use It Safely VAS 461
26 av. The Circular Saw - How To Use It Safely VAS 462
27 av. The Power Grinder - How To Use It Safely VAS 463
28 av. The Radial Arm Saw - How To Use It Safely VAS 464
29 av. The Portable Electric Saw - How To Use It Safely VAS 465
30 av. Care and Maintenance of Arc Welding Equipment VAS 470

Transparencies

31 av. Gas Welding Safety
32 av. Inert Gas Welding
33 av. Shielded Metal-Arc Welding

F. Agricultural Electrification Cluster

Slidefilms

34 av. Diagramming Electrical Wiring Circuits VAS 401-65
35 av. Identification of Electric Wiring Items VAS 404C
36 av. Electric Motors Part 1, Magnetism and the DC Motor VAS 412
37 av. Electric Motors Part 2, Induction and the AC Motor VAS 413
38 av. Electric Motors Part 3, Testing and Identifying Leads; Connecting and Reversing VAS 414
39 av. Electric Motors Part 4, Trouble Shooting Vas 415
40 av. Cleaning Electric Motors VAS 416
41 av. Practical Maintenance of Electric Motors VAS 417
42 av. The Safe Use and Care of Ladders VAS 497

Transparencies

43 av. Wiring Exercises

Source: Deere and Company, Distribution Service Center -- Dept. S/P 1400 - 3rd Avenue, Moline, Illinois

A. Agricultural Power and Machinery Cluster

Slide Sets

44 av. Tractors FMO-102S
45 av. Safety FMO-182S
46 av. Preventive Maintenance FMO-162S
47 av. Combine Harvesting FMO-152S
48 av. Machinery Management FMO-172S
49 av. Tillage FMO-112S
50 av. Planting FMO-122S
51 av. Hay and Forage Harvesting FMO-142S
52 av. Hydraulics FOS-10 Slides
53 av. Electrical Systems FOS-20 Slides
54 av. Engines FOS-30 Slides
55 av. Power Trains FOS-40 Slides

Transparency Masters

56 av. Hydraulics FOS-10 Masters
57 av. Electrical Systems FOS-20 Masters
58 av. Engines FOS-30 Masters
59 av. Power Trains FOS-40 Masters

Films and Videotapes

60 av. Clean Air (film) SX-1073
61 av. Efficient Cooling (film) SX-1074
62 av. Lubrication (film) SX-1075
63 av. Clean Fuel (film) SX-1076
64 av. Set of 4 on Videotape VTR-72049

Source: American Association for Vocational Instructional Materials, Engineering Center, Athens, Georgia

F. Agricultural Electrification

Slide Sets

65 av. Understanding Electricity and Electrical Terms
66 av. Maimtaining the Lighting and Wiring System

Transparencies

67 av. Electric Motors, Selection - Protection - Drives

Black and White Masters

68 av. Understanding Electricity and Electrical Terms
69 av. Maintaining the Lighting and Wiring System
70 av. Electric Motors, Selection - Protection - Drives

TEACHERS' COMPETENCIES AND TRAINING AVAILABLE

Opportunities exist for agricultural mechanics instructors to upgrade their skills and understandings. A partial list follows:

1. Request area community colleges, four-year institutions, Division of Vocational and Technical Education, Illinois Vocational Association, Vocational Agriculture Service, and Industry to conduct workshops in special area of interest.

2. Attend inservice workshops held during the annual Agricultural Occupations Teachers' Conference in June.

3. Attend state-wide meetings in agricultural mechanics.

4. Attend area meetings conducted by Extension Service.

5. Enroll in on-campus or off-campus course work at four-year institutions.

6. Enroll in university correspondence courses in agricultural engineering.